

RoboBraille – Braille Unlimited

By

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For many people, Braille is difficult to learn, cumbersome and costly to produce and hard to obtain. RoboBraille is an email-based service capable of translating documents in various popular formats to and from contracted Braille, to visual Braille and to audio files. Available free of charge to all non-commercial users and with no registration requirements, the RoboBraille service attempts to solve a universal problem as it makes textual information accessible to people who would otherwise find it inaccessible due to visual impairments or reading difficulties. Originally a Danish invention, the service has been operational in Denmark since the summer of 2004. From July 2006 to December 2007, the RoboBraille service was validated in Cyprus, Ireland, Italy, Portugal and the United Kingdom with financial support from the European Commission under the eTEN programme in order to verify its technical, commercial and cultural viability. Building on the results of the pan-European validation and with funding from the Danish Government and other sources, the RoboBraille development team is currently engaged several projects aimed at improving the service by adding functionality, increasing the number of supported languages and supporting the service with media production capabilities and electronic libraries. The objective is to create an unlimited supply of material in Braille and other accessible formats to anyone, anywhere with a need.

Introduction

For many people, Braille is difficult to learn, cumbersome and costly to produce and hard to obtain. This is the case even in developed countries in Europe, North America, Australia and New Zealand. The challenges of learning, producing and obtaining Braille are not made less tricky by the fact that Braille comes in a vast number of varieties. Not only does Braille differ from country to country and from language to language: Braille also varies according to domain (e.g., literary Braille, scientific Braille, Braille music, Braille poetry and pharmaceutical Braille), medium of rendition (six-dot Braille for paper, eight-dot Braille for computers), and contraction levels (from two levels in British English Braille to five levels in the recently revitalised Norwegian Braille code). Added to this comes the issue of Braille character sets. Although ISO codes and a Unicode [1] for Braille exist, few Braille devices adhere to these. Rather, different devices such as Braille note takers and Braille embossers appear to implement different Braille character sets according to the countries in which these have been deployed and the vendors responsible for the deployments. This is – in principle – the challenge to which the people behind the RoboBraille service set out to address in 2004: To introduce a preferably free and easy-to-use system capable of producing Braille according to the particular language- and domain-specific Braille code mandated by the text in question, at whatever contraction level requested by the user, and rendered as either six-dot or eight-dot Braille in a Braille character set specified by the user.

In Denmark and other developed countries, software to translate to and from contracted Braille in multiple languages has been available since the mid 1980s [5]. Although the systems are fairly easy to use, fast, accurate, well-promoted by the support system and – in some cases – available free of charge as downloads from websites, they are not being widely used amongst teachers, Braille readers and others with a need to produce contracted Braille. Traditionally, translating documents into contracted Braille is a time consuming process that requires a wide range of different skills: In addition to mastering the Braille translation software, translators must have a high level of proficiency in handling various document types, document conversion technologies, Braille devices and Braille character sets. And since Braille translation is a niche with limited resources, software is constantly being updated with software patches. For professional Braille translators, these issues may not pose a problem. However, for the occasional translator – e.g., a primary-school teacher with an integrated blind pupil or a blind Braille reader – they do.

RoboBraille was introduced by Synscenter Refsnæs as an alternative to the decentralised, user-centric Braille translation systems used widely to produce Braille at varying levels of contraction [3]. Based on experience from developing automated Braille translation solutions during past 20 years, RoboBraille is a centralised, e-mail based translation service that automates the translation process, including any pre- or post processing steps required to convert between document types, formats and character sets. Since the RoboBraille interaction model exploits e-mail, the solution is platform-independent and the only skill needed to use the service is the ability to send and receive an email with a document attachment. The RoboBraille architecture is based on standard internet technologies and can be managed centrally. Consequently, the solution is robust, highly scalable, always up to date and can be operated by a minimum of efforts. Since its inception in 2004, RoboBraille has responded to more than 500,000 user requests, currently serving between 500 and 1,000 requests from end-users per day.

The general business idea of RoboBraille has been on the one side to provide a free high-quality public translation service to print impaired people, while on the other charging institutional and/or commercial users a reasonable amount for using the service. In order to be sustainable, the RoboBraille service must have a critical mass of users. As it is unlikely that a critical mass of users can be found in any single country and amongst members of the primary target audience (the visually impaired), the RoboBraille is offered to the global user community; similarly, the service is promoted to a wide range of user groups: Visually impaired, dyslexic, poor readers, illiterates and – even – the general public. As a consequence, RoboBraille not only produces Braille. Right from its inception, synthetic speech has been an important capability.

Working with RoboBraille

Users interact with RoboBraille by means of email. A range of email accounts are used to control the various translation and conversion capabilities of RoboBraille. Users submit documents (e.g., text files, Word documents, Rich Text Format documents, HTML pages, XML documents) as email attachments. The translated results are returned to the user via email, typically within a matter of minutes.

The user interacts with the RoboBraille service by sending emails to specific email accounts. The figure below illustrates how a user interacts with the system in order to have a document translated into contracted Braille:

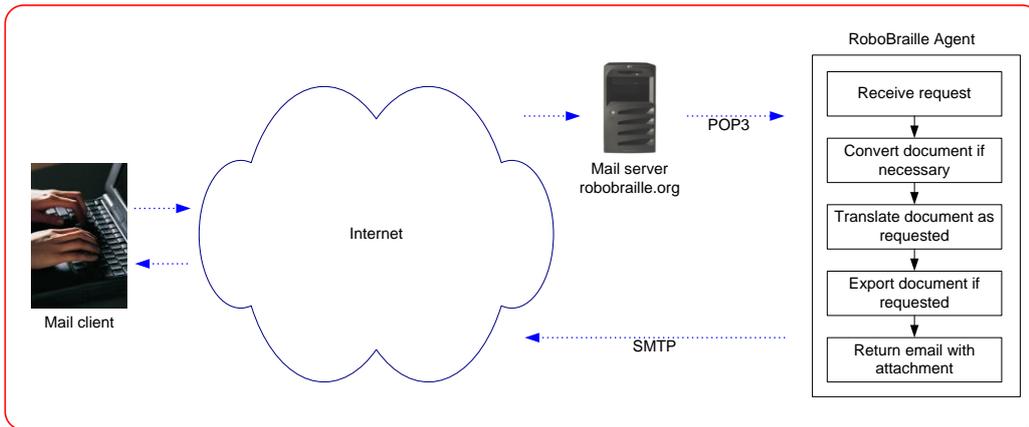


Figure 1: The RoboBraille Braille translation process

Prior to translation, Word and RTF files are converted into text. Depending on the size of the file, the traffic and server workload, a result is typically returned to the user in a matter of minutes of submitting a request for translation. RoboBraille assumes that the source document is written in the standard Windows character set for Western Europe (ISO 8859-1/Latin 1/Windows codepage 1252). Furthermore, the system supports automatic conversion of older ASCII documents with the file-type .asc to Windows text files. Once translated, the document is returned in OctoBraille 1252, a Braille adaptation of the standard Windows character set used in Western Europe developed by Synscener Refsnæs [2]. Since few Braille devices share the same character set, RoboBraille can convert the translated document into a range of different formats to accommodate Braille note takers and embossers. Such conversion is achieved by specifying the name of the Braille character set in the subject line to the email. These are called export filters and some of the most popular export filters are listed below:

Export filter	Meaning
nacb	North American Computer Braille
germanascii	German ASCII
eurobraille	EuroBraille
brailnote	Braille Note (setting for Royal National College of the Blind)

Table 1: Popular Export Filters

Likewise, the user may request a document be translated into synthetic speech. The process is similar to that of Braille translation, although some of the steps are different. The illustration below illustrates how a user may use the RoboBraille service to translate a document into synthetic speech:

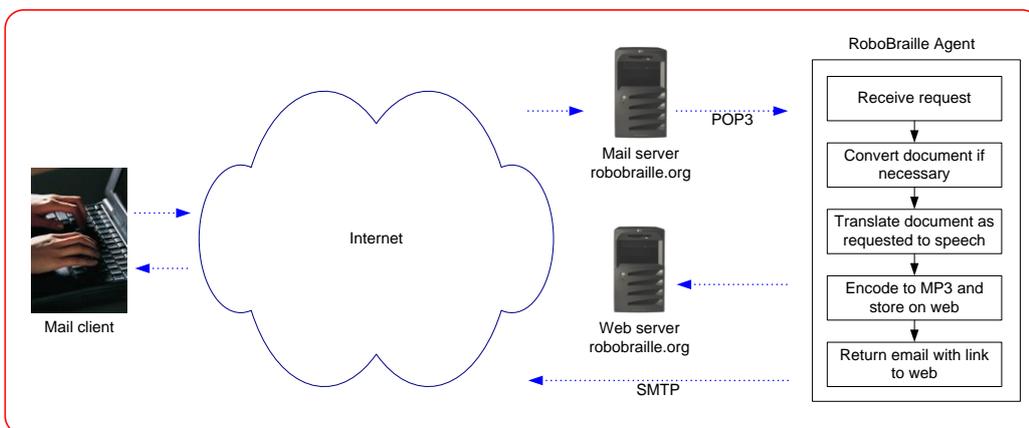


Figure 2: The RoboBraille text-to-speech translation process

First, RoboBraille translates an attached document into a WAVE file. WAVE files are rather large and unsuitable for transmission via the Internet. Therefore, the WAVE file is subsequently encoded and compressed into an MP3 file. The resulting audio file is copied with a unique name to the web server using FTP, and a link to the file is returned to the user.

The table below lists some of the most popular RoboBraille email accounts:

Mail account	Functionality
sixdot@robobraille.org	Translated the attached document into Grade 2 Braille according to the British English six-dot Braille code.
fulltext6@robobraille.org	Translated the attached document into Grade 1 Braille according to the British English six-dot Braille code.
sekspunkt@robobraille.org	Translates the attached document into Major Contraction Braille (Grade 2) according the Danish six-dot Braille code.
ottepunkt@robobraille.org	Translates the attached document into Major Contraction Braille (Grade 1) according the Danish eight-dot Braille code.
lille6@robobraille.org	Translates the attached document into Minor Contraction Braille according the Danish six-dot Braille code.
lille8@robobraille.org	Translates the attached document into Minor Contraction Braille according the Danish eight-dot Braille code.
fuldskrift6@robobraille.org	Translates the attached document into Grade 1 Braille according to the Danish six-dot Braille code.
fuldskrift8@robobraille.org	Translates the attached document into Grade 1 Braille according to the Danish eight-dot Braille code.
brailleseipunti@robobraille.org	Translates the attached document into Grade 1 Braille according to the Italian six-dot Braille code.
potbraille@robobraille.org	Translates the attached document into Grade 1 Braille according to the Greek six-dot Braille code.
textoparabraille@robobraille.org	Translates the attached document into Grade 1 Braille according to the Portuguese six-dot Braille code.
britspeech@robobraille.org	Translates the attached document into an mp3-file with synthetic speech using a British English Text-to-Speech engine.
tale@robobraille.org	Translates the attached document into an mp3-file with synthetic speech using a Danish Text-to-Speech engine.
tydeligtale@robobraille.org	Translates the attached document into an mp3-file with synthetic speech using a Danish Text-to-Speech engine set to clear pronunciation
audio@robobraille.org	Translates the attached document into synthetic speech using an Italian Text-to-Speech engine.
parlefrançais@robobraille.org	Translates the attached document into synthetic speech using a French Text-to-Speech engine.
textoparavoz@robobraille.org	Translates the attached document into synthetic speech using a Portuguese Text-to-Speech engine.
potspeech@robobraille.org	Translates the attached document into synthetic speech using a Greek Text-to-Speech engine
aistis2@robobraille.org	Translates the attached document into synthetic speech using a Lithuanian Text-to-Speech engine.

Table 2: Popular RoboBraille email accounts

In addition to the mail accounts listed above, RoboBraille supports a number of accounts to partition files into smaller fragments and to convert documents between different formats.

The eTEN RoboBraille Market Validation Project

In order to venture beyond the borders of Denmark, Synscenter Refsnæs approached the European Commission in 2005 with a proposal that was subsequently accepted under the eTEN pan-European market validation programme. Consequently, an eTEN RoboBraille market validation project was conducted from June 2006 until December 2007 in Cyprus, Ireland, Italy, Portugal and the United Kingdom with financial support from the European Commission.

As part of the eTEN RoboBraille market validation project, the RoboBraille services was prepared for a multinational market environment in a number of ways:

- The technical platform was scaled up from two to 10 RoboBraille agents; the current platform has a current maximal capacity of 600 requests per hour or 14,400 requests per 24-hour cycle. During the pilot tests, the architecture proved scalable and additional agents can be added to increase capacity should the need arise.
- The RoboBraille service was stress-tested with a large number (2,000+) of users, both registered pilot test users and other users with a variety of document types, document sizes and translation processes. The service proved highly stable and capable of servicing the users without undue delay.
- The RoboBraille service was adapted to English, Portuguese, Italian, Greek, French and (partially) Lithuanian, making it directly usable in a number of countries. In addition to the actual adaptation, the development team gained valuable experience in adapting the RoboBraille service to new languages, and developed a framework for doing so.
- The RoboBraille service was adapted to support Braille devices and Braille embossers used in many European countries.
- The RoboBraille partner organisation gained experience in providing end-user support in Ireland, United Kingdom, Italy, Portugal and Cyprus.
- Dissemination activities and the pilot programmes created awareness of the existence and capabilities of RoboBraille amongst potential individual and commercial users.
- The RoboBraille service was awarded the 2007 Social Contribution Award by the British Computer Society in recognition of importance of the service to the print impaired.

As part of the project, the RoboBraille service was piloted by more than 1,500 users in two pilot tests [4]. Following each pilot, users were asked to complete questionnaires devised to collect quantitative ratings as well as qualitative information. In terms of quantitative information, the studies were designed to measure the following indicators on a scale of 1-5 (5 being best):

- Overall satisfaction with the service
- Quality of the service
- Accuracy of the service
- Relevance of the service

In terms of qualitative information, the studies were designed to capture information within the following areas:

- Concerns with the service (e.g., privacy, confidentiality, Intellectual Property Rights (IPR))
- Suggestions, recommendations and ideas for improvements

Based partially on user suggestions from the first pilot, the service was improved slightly between the two pilots. The numeric ratings confirmed the user satisfaction with the RoboBraille service; they furthermore proved beyond doubt that the RoboBraille service is relevant, easy to use and of high quality.

The table below summarises the numeric ratings of the questionnaire surveys following both pilots:

	Overall satisfaction	Support	Accuracy	Ease of understanding	Ease of use	Relevance	Quality	Appreciation of improvements
Pilot 1	3,8	4,2	3,9	4,4	4,4	4,0	4,1	N/A
Pilot 2	3.9	4.2	4.1	4.3	4.6	4.3	4.3	4.3

Table 3: Numeric ratings of the RoboBraille service

As can be seen from the table above, users have rated the service higher in all but one category in the second pilot compared to the first pilot. Only in terms of Easiness of understanding the concept of the service has the

rating dropped from 4.4 to 4.3, which can be considered insignificant. On rating the appreciation of the improvements introduced between the two pilots, these reach an approval rate of 4.3.

In addition to the numeric ratings, users provided a host of important information on suggested improvements and perceived concerns of the service. Whereas the suggested improvements mainly included suggestions for functional improvements, the perceived concerns concerned privacy and copyright issues.

RoboBraille – The Next Steps

From a technical, support and marketing point of view, RoboBraille is currently running as a fully supported service in Cyprus, Denmark, Ireland, Italy, Portugal and the United Kingdom. Furthermore, the RoboBraille team is well-prepared to enter other European countries such as Greece (existing Cypriot solution can be reused), Lithuania (advanced contacts have been made and a speech synthesiser already donated and integrated) and France (advanced contacts have been made, a speech synthesiser has been donated and integrated, and assistance with the French Braille adaptation has been agreed).

Likewise, the RoboBraille team is prepared to offer the service to speakers of English (e.g., Australian, the US, Canada, New Zealand) and Portuguese (e.g., Brazil, Mozambique, Angola). Finally, with assistance from the World Health Organisation and the International Telecommunications Union, the RoboBraille team has made contact to a number of interested parties throughout the Arab world, adding the illiterate to the target audience.

In the spring of 2008, the RoboBraille service was granted a multi-year subsidy on an amendment to the Danish State Budget¹ allocated to support social purposes. These funds are being used to finance the ongoing operation of the service, for dissemination, and to improve the services currently offered by RoboBraille. In terms of functional improvements, these will include the following:

- Adding formatting capabilities to the RoboBraille service, enabling the service to adequately format Braille output prior to rendition on Braille embossers. These capabilities are currently being implemented in collaboration with the National Danish Library for the Blind as part of the AutoBraille project.
- Adding support for new document formats including docx (new Microsoft Word format), ODF and OpenXML. RoboBraille currently supports Microsoft Word, RTF, HTML, XML and text documents.
- Adding full support for multi-byte Unicode documents, paving the way for support for multi-byte languages such as Russian, Chinese and Hindi.
- Complementing the current email-based interaction model with an interface based on web-services, thus enabling institutional users (e.g., public sector institutions, banks, pension companies, utilities) to exploit RoboBraille themselves in order to provide documents in alternative formats for the benefit of print-impaired citizens.
- Adding Braille and speech support for a range of popular foreign languages including Unified English Braille, German, French, Spanish and Russian, thus enabling print impaired Danish foreign-language students (and foreign-language students from elsewhere) the ability to access Braille and speech material in these languages.

The RoboBraille service has furthermore received one-off financial support from the Danish Ministry of Education in order to develop the service to better support the dyslexic and people with poor reading skills. In addition to dissemination, these funds are being used for the following functional improvements:

- Adding support for the creation of structured talking books in the standardised DAISY format.
- Adding support for complex document formats such as Adobe PDF
- Adding support for scanned images such in formats such as GIF and TIFF

¹ Satspuljen

In addition to these activities, Synscenter Refsnæs has received a private grant that will enable it to add support for Arabic speech to RoboBraille, and is in negotiations with a private foundation in order to secure funding for support for several Eastern European languages. Likewise, the RoboBraille team is in dialogue with several agencies and other major Braille producers worldwide on adding support for additional languages.

Obvious additions to the RoboBraille service include the creation of media production facilities and electronic libraries. The RoboBraille team is currently exploring how one or more media production facilities may be established, possibly doubling as educational and vocational training facilities for people with a visual impairment. Similarly, the RoboBraille team is exploring how the RoboBraille service may be complemented by one or more electronic libraries to make electronic material available for people with a visual impairment or a reading disability. The first media production facilities and electronic libraries are expected to be created in 2009.

Conclusions

The RoboBraille was developed in an attempt to make Braille easily available to anyone with a need. In order to create a critical mass of users, it was decided to venture beyond the borders of Denmark and produce a multilingual service capable of producing textual information in alternative formats not only for the blind, but also for partially sighted, dyslexic and people with poor reading skills.

Although alternatives exist – centralised media production facilities, personal translation solutions, screen readers, scanning and reading software – it is evident that such alternatives are less popular amongst the users, be it for reasons of cost or skills. Rather than positioning the RoboBraille service against such solutions, user statistics and results of user pilots suggest that the concept of a free, centralised email-based service offered by RoboBraille is preferred by many users.

In addition to the end-users, several government agencies and private funds alike appear to recognise the potential of the RoboBraille service as a facilitator for social inclusion. As such, the RoboBraille service will continue to evolve in order to obtain its objective: To create an unlimited supply of material in Braille and other accessible formats to anyone, anywhere with a need.

References

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