

PONDD: an online platform for printing -on-demand and delivery of daily press, magazines and books

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Abstract. Motivated by difficulties experienced in the distribution of printed press, mainly daily press, i.e., newspapers, but also sometimes of periodical press, i.e., magazines, or even books, we designed and developed PONDD, an online platform for printing on-demand and delivery of daily press, magazines and books. PONDD can serve as an innovative service which can directly bring together readers and publishers via printing points, like for example kiosks or mini markets. Readers can select their desired newspaper, magazine or book, define their desired features for the print (e.g., single/duplex, colored/black&white) and choose an available nearby printing point for serving their requests, i.e., for picking or having delivered to them their selected newspaper, magazine or book. PONDD is easy and responsive offering a comprehensive set of defined functionalities. In our current era, information is a critical resource and the internet should be exploited not only as a modern information distribution channel but also as a backbone for supporting the continuation of undisturbed and uninterrupted distribution of traditional printed press.

Keywords. Online platform, press, printing on-demand free, undisturbed and uninterrupted distribution of printed press, environmental sustainability, Angular, Typescript, Java, Spring

1. Introduction

The traditional printing industry, particularly for daily press such as newspapers, periodical press like magazines, and books, faces several significant challenges. The primary issues stem from the inefficiencies in the distribution and printing processes [1], [2]. Overproduction is a major problem, with publishers often printing large quantities of materials to anticipate demand. This approach leads to substantial waste when unsold copies are discarded. Additionally, maintaining large inventories of printed materials incurs high storage costs and requires significant logistical coordination, further increasing operational expenses.

Distribution is the most crucial issue in the traditional printing industry [3]. The time required to transport printed materials from central warehouses to various retail points or directly to customers can be considerably high [4]. This issue is worsened for more remote places such as islands, villages, and other remote areas, where the distribution process is significantly slower. The logistical challenges involved in reaching these remote locations include limited transportation options, longer travel distances, and infrequent delivery schedules. As a result, readers in these areas often experience delays in receiving their daily press, which can negatively impact customer satisfaction and the perceived relevance of the content. This issue is especially critical for daily press and news, which are expected to be delivered in the very early hours before the day starts. Ensuring that newspapers are available for

readers in the morning requires overnight printing and early morning distribution, which is both inconvenient and costly for printing points and the daily transfer logistics. The requirement for early morning deliveries places additional strain on logistical operations, leading to increased operational costs and potential delays that can undermine the relevance of the news content. Implications can arise in cases where distribution is performed by a single agent/company thus creating room and conditions for potential symptoms of monopolistic situations negatively impacting readers and publishers as well as freedom of information and freedom of press [5], [6], [7], [8]. Moreover, the environmental impact of traditional printing and distribution practices cannot be overlooked. The logistics involved in transporting printed materials contribute to a significant carbon footprint, and the waste generated from unsold copies also senses the environmental impact the printing industry has.

From a socio-culture perspective [9], [10], [11], [12], it is important for readers to maintain the traditional option of getting the news via real, printed newspapers. Older people who are not familiarized with digital devices and electronic services find it too hard to read the news through scrolling on a tablet while deeply appreciate their rather ceremonial daily habit of going to a kiosk and purchasing a printed newspaper to spend their day on. Also, younger people, despite being familiarized and even highly skilled in digital technology and services, still wish to have the option of slowing down their life pace via reading a classical, printed newspaper, magazine or book. In our current internet-based era, it seems that digital press is promoted as a single option continuously limiting the room for printed press. But, limiting choices down to singletons does not support freedom, independence and free will that individuals must enjoy in healthy and functioning societies.

To address these problems, we designed and developed PONDD, an online platform for printing on-demand and delivery of daily press, magazines, and books. PONDD connects readers and publishers directly through local printing points, such as kiosks or mini-markets redefining, rationalizing and normalizing the role of intermediaries and distribution of press. Readers can select their desired newspaper, magazine, or book, customize the option (e.g., single/duplex, colored/black & white), and choose a nearby printing point for pick up or delivery. PONDD eliminates overproduction by allowing on-demand printing. Printing points only print the number of copies that are ordered, greatly reducing waste and saving resources. The platform reduces the need for large inventories and extensive storage facilities, cutting storage costs and simplifying logistics. Local printing points print materials as orders are placed, ensuring efficient use of resources. This model not only saves money for publishers but also reduces the complexity and cost of distribution. PONDD eliminates the most crucial problem the printing industry, distribution. By decentralizing the printing process, publishers can now meet early morning delivery demands without the heavy logistics of traditional methods. This makes it easier for printing points and ensures newspapers are up to date and on time. Moreover, reducing the need for long distance transport to remote places improves delivery times and reliability for readers in islands, villages, and rural areas. This means that even in the most remote locations, readers can have the latest news and magazines delivered without significant delays.

Additionally, significant benefits for small kiosks and mini-markets are gained with the use of the platform. These small businesses can become printing points without the risk of buying large quantities of newspapers and magazines upfront. Since printing is on-demand, these businesses do not need to worry about unsold inventory. This model allows them to offer a wide range of publications, attract more customers, and earn additional income with minimal risk. By partnering with PONDD, small kiosks and mini-markets can increase their profitability and provide a valuable service to their communities.

To the best of our knowledge, no similar application for printing on-demand and delivery of press (i.e., daily or weekly newspapers, magazines) currently exists, at least at a national level (i.e., the relevant market in Greece). While there are applications that offer on-demand services for books, none provides a decentralized solution for both daily press and books with the specific benefits and problem-solving approach that PONDD offers.

PONDD application has been developed via the exploitation of a robust set of open technologies. For the frontend, it utilizes Angular and Angular Material 14, alongside Node.js and Typescript, to create a responsive and dynamic user interface. Key libraries like Chart.js and Google Maps are integrated to provide interactive data visualization and location services. The backend is powered by Java 17 with Spring and Spring Security 3.2 frameworks to ensure secure and efficient SURFHVV LQJ ZKLOH \$:6 LV XVHG IRU ILOH XSORDGV 7KH DSS ensuring reliable and scalable database management.

The rest of the paper is structured as follows. In Section 2, we address in detail the design and implementation of the system. In Section 3, we present a use scenario to demonstrate the functionalities, including the interactions between publishers, users, and printing points. We conclude in Section 4 by discussing the results, the positive impacts on all involved parties as well as on the environment and even society and outlining potential future enhancements.

2. System implementation

PONDD, short for Printing ONDemand and Delivery of daily press and books, revolutionizes the delivery and distribution of print press such as newspapers, magazines, and books. It connects readers directly with local printing points via a digital platform, eliminating the need for extensive inventory and reducing waste. The system is designed to cater to three main user roles: Customers, Publishers, and Printing points, each with tailored access and functionalities within the platform to suit their specific needs. After successful sign from PONDD main page (<https://pondfrontendf7866f45f380.herokuapp.com/home>) users according to their role are redirected to a specific environment tailored for their needs. Users can interact with the PONDD system through a dedicated portal (<https://pondfrontendf7866f45f380.herokuapp.com/shop>), where they can choose publications, order, customize printing options, and select nearby printing points for pickup or delivery. Publishers access their management interface (<https://pondfrontendf7866f45f380.herokuapp.com/publisher>) to upload new content, manage publications, and track orders and distribution analytics. Printing points use their specialized dashboard (<https://pondfrontendf7866f45f380.herokuapp.com/printpoint>) to handle print requests, manage operational settings, and update order status.

2.1. User interface and functionalities

In this section, we present the user interface and the functionalities of the PONDD application. We provide detailed descriptions and screenshots to illustrate the available features and the user experience for different roles within the system. The PONDD application offers distinct interfaces and functionalities tailored to specific user roles, ensuring a seamless and efficient experience for all users. In particular, we address interface and functionalities offered to authenticated and non-authenticated users, that is functionalities available to registered users and visitors who browse the application ZLWKRXW ORJJLQJ LQ UHVSHFWLYHO\ 7KHQ ZH DGGUHV V LQV who upload and manage their publications. Finally, we address interface and functionalities offered to Printing points that handle print requests and manage orders. We include screenshots of the relevant interfaces and describe the key functionalities available to users in each category/role.

2.1.1. Authenticated / non authenticated users The PONDD home screen, available to both authenticated and non-authenticated users, is shown in Figure 1. Users have the option to filter items based on category, change the current language of the system, and choose whether to sign up (i.e., register) or sign in (i.e., log in). Additionally, there is a functionality to view a list of current printing points, where details of each printing point can be seen and a PDF containing these details can be downloaded. Users can also display a map, filter it based on their postal code, and view all nearby printing points. Furthermore, there is an accessibility menu available, as well as options at the footer for additional information about the application.

Figure1. Home page

Upon selecting an item, the system redirects to the item details page. As shown in Figure 2, this page provides full details for the selected item, including the availability period, full description, author, number of pages, and cost. The preview image is displayed in full size, making it more visible. The option to 'Add to cart' is not available to non-authenticated users.

Figure2. Item details

\$IWHU VHOHFWLQJ 36LJQ LQ 5HJLVWHU' IURP WKH WRS ULJKV
the system prompts the user to select an action from the access modal, as shown in Figure 3.

Figure3. Sign in / Sign up modal

After signing in as a 'User', the home page shown in Figure 1 appears while the "Add to cart" option (depicted in Figure 2) is now enabled. While logged in, users can see two widgets at the top bar: the cart widget, which displays the items added to the cart, and the account widget, which shows the username of the authenticated user. This setup allows users to easily verify their authentication status. \$GGLWLRQDOO\ WKH ZLGJHW SURYLGHV D GURSGRZQ PHQX Z I details" where they can edit details of their account apart from username and registered email, and "Orders" where placed orders are available. These widgets are depicted in Figure 4, where cart details are shown so that users can see the items that are added to their cart before finishing the order. proceed with their order, users must select a printing point for each item to be printed. There are also options regarding printing preferences like for example printing method, paper type, print quality which may alter the print cost of each item. The system calculates the printing cost based on the selected printing preferences, item cost and pages and informs the users for the resulting total cost. The default delivery method of each item can be also changed. If "Deliver to address" is chosen, further location details must be filled in during the next steps before the completion of each order.

Figure4. Cart details

After proceeding with the order in Figure 4, the user must select either the payment option "Card" where card details are requested, or "Pay with cash" to complete the order. As shown in Figure 5, after

a successful order placement, the system displays an overview with the most important information regarding the order just placed. The order ID is prominently shown, and detailed information about the selected printing options and the selected printing point for each item can be viewed by expanding the available dropdown menus. There is also the option to download a PDF with the order details.

Figure5. Order Successful

Lastly, the authenticated user can be redirected to the "control panel" through the dropdown menu in account widget, choosing either the "Orders" or "Account" option. As shown in Figure 6, the control panel provides options for the user to edit their account details and change their password. Users can view current and past orders and filter them based on the order reference number or the date the order was submitted. Detailed information about the order is displayed, including the order number, date ordered, total items, and total cost. Each item within the order is listed with its reference number, title, price, and status (ready or pending), and users can view the selected printing point and print options for each item. Users can download a summary of the order as a PDF or select and download more detailed information for an order item as a PDF. The control panel follows a clear and easy to use design, featuring filters that help users find their desired orders quickly and provide informative navigation options. Users can easily manage their accounts and orders through a clear side menu that displays all available options.

Figure6. Customer control panel

2.1.2. Publisher When a publisher logs into the system, the main page, shown in Figure 7, features an interface similar to the "control panel" used by customers. The publisher can navigate through various options via the side navigation bar. Users in the category "Publisher" can edit their account details, change passwords, view current uploads, upload new items, and examine analytics and history related to their uploads through visualizations. Current uploads are categorized into three sections based on their status: active, upcoming, and deleted. The status of an upload is determined by the availability period set for the item. Additionally, within each section, there are filters available to sort uploads by category (newspaper, magazine, other) and by upload date, enhancing the publisher's ability to manage and view content efficiently. When publishers upload an item, they must enter several mandatory fields: a preview image, the content of the item as a PDF file, the main title, number of pages, price, category, and item availability. Additionally, publishers can set optional fields that may be more suited to the type of the upload, such as author, short description, and full description. These fields allow for an extensive description of the item, making it easier for customers to understand and choose items to print on demand. When publishers upload an item, they select an availability period that spans from the current day to future dates. If a future date is selected, the item is set as "upcoming" and publishers can make changes to this item until the start date arrives. Once the start date is reached, the item is marked as "active" and becomes available for ordering. If the availability period ends, the item is marked as "deleted" and is no longer available for ordering. However, publishers have the option to restore it by selecting a new availability period.

Figure7. Publisher active items

)LJXUH LOOXVWUDWHV WKH LQWHUIDFH RI WKH SXEOLVKHUV that provides insights into the distribution of uploaded items across different categories: newspapers, magazines, and others. These categories are represented as percentages based on the total number of items uploaded. Additionally, two bar charts visualize data concerning the orders per date for the uploaded items and uploads publisher has made per date. A dropdown menu is also featured, enabling publishers to select one of the uploaded items to view specific data related to that particular item.

Figure8. Publisher analytics

2.1.3. Printing Point Printing point owners are offered an interface similar to that of the publishers but designed to their specific needs. As shown in Figure 9, there is a ~~left side~~ containing options to edit account details and printing point details. The "Edit printing point details" functionality allows owners to change the name, email, and phone number of the printing point.

Figure9. Printing point pending order

There is also the option to modify the current location of the printing point through a modal, where the owner must select a specific position on a map. PONDD provides customers with detailed information, including the exact location of the printing point on the map (an example is depicted in Figure 10). Orders are structured in dropdowns based on their status: pending, completed, and rejected. Within each category, the functionality to filter orders by order date or by order reference number is provided, enhancing viewing convenience and facilitating easier navigation. Depending on the type of the order status selected, the owners of printing points can reject or accept submitted orders and view details crucial for processing orders, such as printing options, shipping information, and customer details. There is also the functionality to download this information locally as a PDF file. Upon completing an order, the system prompts the owner to fill in the printing ~~cost~~ filing printing cost, the owner ~~views~~ previews the content before sending it for printing and completing the order. If the owner chooses to reject the order, a reason for rejection must be provided, and the customer is

informed of this reason. The printing point has six days to update a "pending order"; if this period elapses, the order is automatically marked as rejected.

Figure10. Edit printing point location

Similar to the interface for analytics available to Publishers, there are printing point analytics offering the option to view orders per month visualized via a bar chart and the percentage of item categories based on total orders visualized via a donut chart as shown in Figure 11.

Figure11. Printing point analytics

3. System implementation

In this section, we provide an overview of the technologies and software used for the development of the PONDD application, organized into three main parts. The first part outlines the overall system architecture. Moving on, the next sections are split into two parts: one focusing on the technologies and software used in the frontend and the other for the backend, each explaining the choice of technologies and software as well as their contribution to a robust and efficient system.

3.1. System Architecture

The PONDD application is designed as a single page application (SPA) [13], an architectural choice that enhances user experience by dynamically updating the webpage with new data from the web server, instead of the traditional method of reloading entire new pages. In an SPA, all necessary

