International Journal Trendy Research in Engineering and Technology
Volume 8 Proceedings of NCCDS-24
ISSN No. 2582-0958

PAGEMASTER: SEAMLESS AUTOMATION FOR FLIPPING AND SCANNING

Padma R , Syeda Nida , Syeda Shaista , Taskeen Aiman , Zeba Erum

Department of Electronics and Communication Engineering
GSSS Institute of Engineering and technology for Women, K.R.S. Road, Mysuru ,India

padmar@gsss.edu.in

ABSTRACT

Automatic page turners play a crucial role in enhancing accessibility and convenience in daily life. In this paper, we present a novel automatic page turner and scanner prototype designed for books with sturdy bindings. The system utilizes servo motors for precise page turning and stores scanned images in the device memory. Our prototype allows users to specify the number of pages to scan, with a capacity of up to 10 pages at a time. The system's design ensures efficient page turning without errors, making it ideal for various applications. Furthermore, our prototype is user-friendly and cost-effective, highlighting its potential for widespread adoption. This paper discusses the significance of automatic page turners in everyday use and demonstrates the effectiveness of our prototype in enhancing accessibility and convenience.

Keywords: Digital Scanner, Voice Control, Multiple Page Flipper, Servomotor, Arduino.

I. INTRODUCTION

Today we are stepping into a world where innovation meets efficiency. Research indicates that many existing page turning tools have been abandoned due to limited physical storage and high maintenance requirements. The primary technical challenge lies in developing a user-friendly, high-quality, and high-speed solution for effortless page turning and scanning. Individuals with physical impairments or disabilities, as well as those with both hands occupied, struggle to turn book pages independently. Librarians face the tedious task of manually scanning each page of physical books to create accessible copies. The current lack of accessible and automated page-turning mechanisms hinders seamless interaction with physical documents, while manual scanning processes can be time-consuming. [1]

This project represents a groundbreaking advancement in book digitization technology, introducing Book Flipping Scanning as an innovative solution to the challenge of manual page-turning bottleneck. Through a contactless approach utilizing servo motors, it enables seamless flipping through book pages. Users can interact with the system via voice commands, facilitated by a dedicated mobile application and Bluetooth connectivity. The system's coordinated operation ensures a smooth workflow from user input to page-turning and scanning, enhancing efficiency and speed. Rigorous evaluation, including tests on various paper types, validates the system's reliability and effectiveness. Beyond book digitization, this technology holds promise for broader applications in libraries, archives, and educational institutions, revolutionizing access to knowledge and information. This, overall, highlights the project's significant contribution to advancing digitization processes and facilitating broader information accessibility.

II. LITERATURE SURVEY

This comprehensive literature survey delves into the advancements made in improving accessibility in reading and document handling for individuals facing disabilities or limitations. The research by Henkel, Schwaiger, and Widmer (2021) introduces an innovative solution for the automatic page-turning of musical scores using Dynamic Time Warping (DTW), although constraints like unidirectional page turning have been identified. Similarly, Afsheen, Danish, and Ahmed (2022) propose an automatic book scanning system employing Arduino and Bluetooth technology, encountering challenges related to setup assistance and accuracy across various page thicknesses. Mirazimzadeh (2020) contributes to the field with a hands-free page-turning solution utilizing wearable motion detection, albeit facing obstacles concerning error rates. Sharbati et al. (2021) present a Raspberry Pi-based robot designed to read and turn pages, yet limitations pertaining to page thickness and font recognition are evident. Meanwhile, Shan et al. (2021) proposed a cost-effective book scanning mechanism, but concerns about potential damage to books and reliability persist. Lastly, Balachandra et

al. (2018) introduced a voice-controlled page-turning system aimed at enhancing reading accessibility, emphasizing the importance of accuracy and usability. Despite the promising nature of these technologies, overcoming challenges such as reliability, accuracy, and usability remains essential for their widespread adoption. Further research and development efforts are indispensable to refine existing systems and promote inclusivity in reading and document management for individuals with disabilities.

III. PROPOSED SYSTEM

Our proposed prototype of an automatic page-turning system is capable of turning pages in response to voice commands, specifying the direction and number of pages. The system demonstrates seamless functionality and responsiveness, highlighting its potential for hands-free page-turning applications.

A. METHODOLOGY

The system's operation begins with the user delivering a command ("left" or "right") into the smartphone's microphone, prompted by LCD display.[2] The user then selects the direction of page turning and inputs the number of pages to turn, after which the subsequent steps are followed. The smartphone's microphone is wirelessly connected via Bluetooth to the system. The dedicated mobile application first processes voice inputs, which are then sent as commands to a Bluetooth module connected to an Arduino UNO board. The Bluetooth module forwards these commands to the Arduino UNO, where the microprocessor interprets them, generating signals to control the servo motors and blower. This mechanism enables the system to turn a single page of a book at a time. Upon receiving the signals, the servo motors, along with the blower, are activated and coordinate their movements to turn the book according to the programmed instructions[3]. After successfully turning the page, the system scans the page based on predefined time delay settings and stores the scanned information in the system's memory[4].

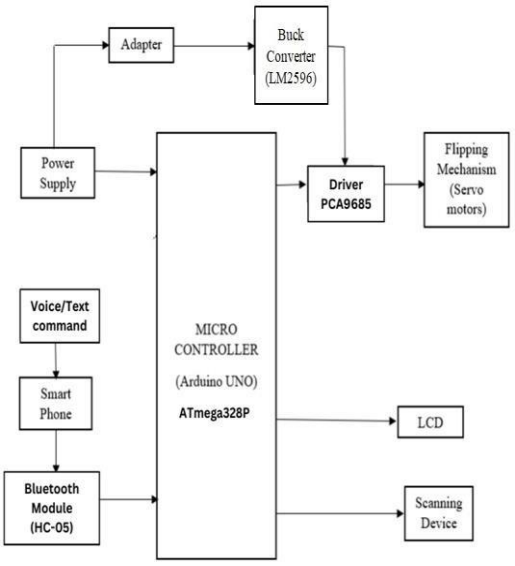

Fig 1: Block Diagram of PageMaster

B. HARDWARE AND SOFTWARE REQUIREMENTS

i. Arduino UNO- ATmega328P

Fig 2: Arduino UNO

The Arduino Uno is a popular microcontroller board based on the ATmega328P chip. It features digital and analog input/output pins for connecting sensors, actuators, and other components. With a USB connection for programming and power supply, it's versatile for prototyping and educational projects. Arduino Uno supports a wide range of libraries and is beginner-friendly for learning electronics and programming.

ii. Servomotors

Fig 3: Servomotor

The MG995 servo motor is renowned for its performance and affordability, making it a popular choice for various applications, especially in robotics and drones. With its ability to provide precise rotation over a 180º range, it is preferred over other motors. Its durability is particularly advantageous for high-wear applications like robotic arms. Additionally, its precision makes it well-suited for use in drones and toy planes, where reliable control is essential.

iii. Servomotor Driver –PCA9685

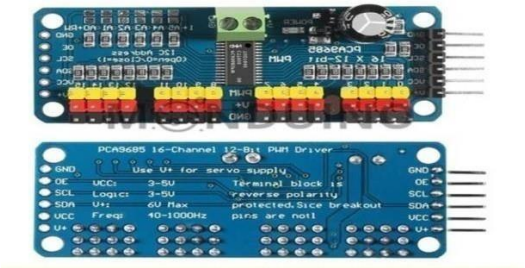

Fig 4: Servomotor Driver –PCA9685

The 16-Channel 12-bit PWM/Servo Driver is a convenient and efficient solution for controlling multiple servos in projects. With the ability to drive up to 16 servos over I2C using only 2 pins, it minimizes wiring complexity and conserves valuable GPIO pins on Arduino or microcontroller. Additionally, the on-board PWM controller handles all 16 channels simultaneously, eliminating the need for the Arduino to manage individual servo movements and reducing processing overhead. This allows Arduino to focus on other tasks, making our project more responsive and efficient. [5]

iv. Bluetooth Module- HC05

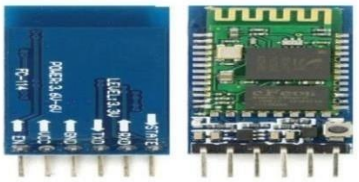

Fig 5: Bluetooth Module- HC05

The HC-05 Bluetooth module offers a straightforward way to establish wireless serial communication, ideal for interfacing with microcontrollers or PCs. It supports full-duplex communication and can be used with devices like Arduino or Bluetooth-enabled phones/laptops. The module's UART communication at 9600 baud rate simplifies integration, and its command mode allows easy configuration. Overall, it's a great choice for projects requiring data transfer between computers/mobiles and microcontrollers wirelessly.

v. DC-DC Buck Converter-LM2596

Fig 6: DC-DC Buck Converter-LM2596

The LM2596 DC to DC buck converter is crucial in automatic page turners for efficiently stepping down voltage to power the page-turning motors. It ensures stable voltage despite input fluctuations, protecting the motors from damage. With its high efficiency, it's ideal for battery-powered devices, extending their runtime. Connecting the LM2596's output to the motor driver circuit allows precise control over the motors, enabling accurate page-turning speed and direction.

vi. 16*2 LCD Display

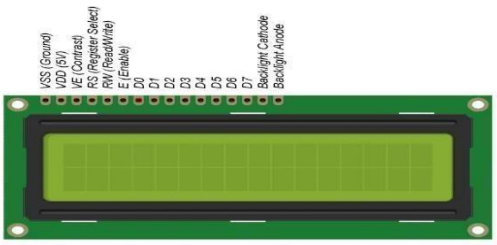

Fig 7: 16*2 LCD Display

A 16x2 LCD refers to a liquid crystal display that can display 16 characters in each of its 2 rows. These displays are frequently employed in electronics projects, particularly in Arduino-based systems, to display various types of information such as sensor readings, messages, or menu options. They typically have a backlight for visibility in different lighting conditions and can be controlled using libraries in microcontroller platforms like Arduino.

vii. Wheel

Fig 8: Wheel

Wheels are circular objects typically made of rubber or similar materials, mounted on axles, and used in vehicles, machinery, or robotics for movement and traction. They come in various sizes and designs, including solid, pneumatic, or semi-pneumatic types, and play a crucial role in determining a device's mobility, stability, and performance on different surfaces.

viii. Arduino IDE Software

Fig 9: Arduino IDE Software

The Arduino IDE is a software platform for programming Arduino microcontrollers, providing a user-friendly interface for code writing, compiling, and uploading. It's open-source, works on Windows, macOS, and Linux, uses a structured code format, supports libraries and board management, includes a Serial Monitor for debugging, and offers options likethe classic or Pro IDE versions.

ix. Bluetooth Terminal App

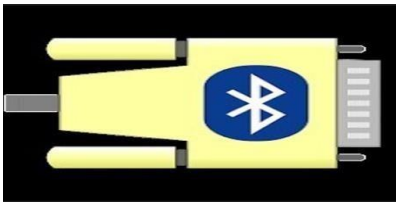

Fig 10: Bluetooth Terminal App

A Bluetooth terminal app allows us to communicate with Bluetooth-enabled devices using yoursmartphone. It typically provides a simple interface where we can send and receive data over Bluetooth. This app is often used for tasks like controlling IoT devices, or interacting with embedded systems.

C. ALGORITHM

The working sequence of the system can be explained by the following steps[10]:

Step 1: Selecting mode of input

LCD prompts the user to give command either through voice or text command as input.

Step 2: Text input

LCD displays to select direction of page turning as right or left by. LCD displays to give input for number of pages to turn. After receiving the input steps 4 to 8 are followed.

Step 3: Voice Command Input

User initiates the process by delivering voice command ("left" or "right") into the smart phone's microphone. The smart phone is wirelessly connected via Bluetooth to the system.

Step 4: Mobile Application Processing

The dedicated mobile application processes the voice input and transmits the corresponding command to the Bluetooth module linked to the Arduino UNO board.

Step 5: Bluetooth Communication

The Bluetooth module receives the command from the mobile application and relays this information to the Arduino UNO board.

Step 6: Information Processing by Arduino UNO

The Arduino UNO board's microprocessor processes the received information, generating signals tailored to control

the servo motors and blower for turning of a single page at a time.

Step 7: Servo Motor Activation

Upon receiving the signals, the servo motors are activated and coordinate their movements to turn the book page according to the programmed instructions.

Step 8: Page Scanning and Storage

After successfully turning the page, the system scans the page based on predefined time delay settings and stores the scanned information in the system's memory.

D. FLOWCHART

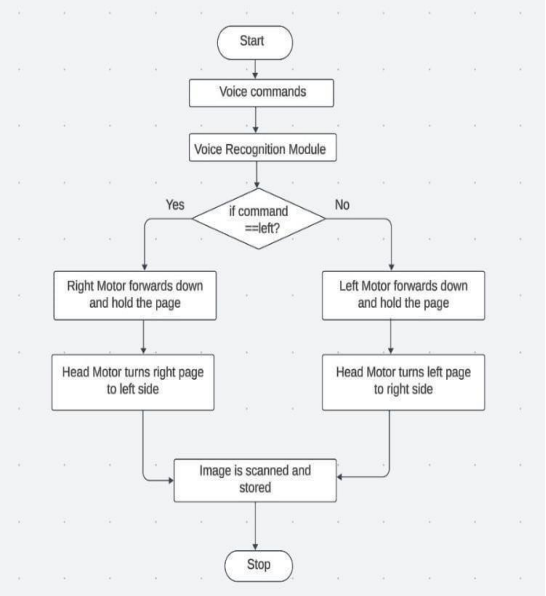

Fig 11: Block diagram of PageMaster

IV. CONCLUSION

The designed prototype is a significant advancement in digitizing physical documents and books, particularly in areas with limited access to advanced scanning technologies. Its simple design and affordability make it suitable for individuals and communities. It efficiently handles larger books with sturdy bindings, ensuring smooth page-turning and. However, it struggles with smaller books with varying page thicknesses, which could be improved with vacuum suction technology and a manually adjustable mechanism. Despite these limitations, the scanner is reliable and easily constructed with available components, serving a wide range of applications from personal use to cultural preservation. Future improvements could focus on accommodating smaller books more effectively and enhancing overall performance and usability, potentially making it an indispensable tool for global digitization efforts.

FUTURE SCOPE

The future scope of our project is promising, with potential enhancements in accessibility through features like voice commands. Integration with AI can enable intelligent document scanning and text recognition, while mobile and cloud integration will facilitate remote control and seamless data management. Security measures, customization options, and IoT integration further expand the project's applications, ranging from accessibility support to collaborative tools and educational solutions, making it a versatile and valuable innovation in document management and automation.

REFERENCES

[1].F. Henkel, S. Schwaiger, and G. Widmer, “Fully Automatic Page Turning on Real Scores”, in Extended Abstracts for the Late-Breaking Demo Session of the 22nd Int. Society for Music Information Retrieval Conf., Online, 2021.

[2]. Misbha Afsheen, Syed Danish, Salman Ahmed , ‘Design and Development of Automatic Book Scanning Machine’, Academy for Technical and Management Excellence College of Engineering, July 2022, Reference No.:-45S_BE_4433. https:// www.kscst.org.in/spp/45_series/ SPP45S/02_Exhibition_Projects/199_45S_BE_4433. pdf

[3].Mirazimzadeh, S.A., McArthur, V. , Automatic Page-Turner for Pianists with Wearable Motion Detector. In: Stephanidis, C., Kurosu, M., Degen, H., Reinerman-Jones, L. (eds) HCI International 2020. https://doi.org/10.1007/978-3-030-60117-1_15

[4]. Lana Sharbati, Omar Taradeh, Manar Iqefan “Book reader & page turner robot using Raspberry pi”, by, January 2021. Palestine Polytechnic Uni-college of IT

[5]. Aaran Shan Abbas Raza Tom Doherty Trevor Chow Kai Sackville-Hii “FlipScan Proposal Document” - School of Engineering Science Simon Fraser University,

[6].K Sowmya 6(2018) Balachandra H N, K Sanjay Nayak, Jnaneshkumar S, K Sowmya, Shreekanth T, 2018, Voice Controlled Smart Page Turner for Differently Abled, Int.Journal of Engineering Research & Technology (IJERT) NCESC – 2018 (Volume 6 – Issue 13),

Biographies

Syeda Nida, a passionate Electronics and Communication Engineering student with a strong focus on innovation. Her projects include Smart Refrigerator, Security-Enabled Switching Techniques for Electric Lines, and Battery Monitoring System for Autonomous Robots. Her contributions reflect a keen understanding of emerging trends and a commitment to advancing the field of engineering. She has a passion for developing solutions that merge technology with practical applications, showcasing her expertise in IoT, automation, and energy management. Nida's work stands as a testament to her dedication to create practical solutions that address real-world challenges, making her a valuable contributor to the field of engineering.

Syeda Shaista, is a fervent Electronics and Communication Engineering student who is nature enthusiast, deeply passionate about exploration and keenly observant in all endeavors. With a focus on innovation, she has spearheaded projects encompassing security-enabled switching techniques for electric lines, smart patient ward systems, home automation solutions, and advanced image enhancement methodologies utilizing color anddepth histogram techniques. Her commitment to excellence and holistic understanding of variousdomains marks her as a visionary in the field of technology. Shaista's contributions exemplify her unwavering dedication to leveraging technology for the betterment of society.

Taskeen Aiman, a dedicated student pursuing a Bachelor's degree in Electronics and Communication Engineering, exhibits a strong passion for continuous learning and innovation. Their proactive approach is evident in projects such as security- enabled switching techniques for electric lines and a laser-based security system, demonstrating a commitment to addressing societal challenges. Taskeen's project on high-performance fingerprint matching systems for large datasets, based on GPU further highlights their technical proficiency and ability to develop impactful solutions. Their projects reflect a deep-seated desire to contribute positively to society, particularly in enhancing safety measures for lineman workers and addressing critical issues such as lineman accidents. Her work exemplifies a proactive and socially conscious approach to engineering, aiming to create a lasting impact on communities and industries alike.

Zeba Erum, is a driven Electronics and Communication Engineering student with a keen interest in embedded systems and IoT. Currently pursuing her degree, she is passionate about exploring innovative solutions in these fields. Zeba has undertaken notable projects, including "Security Enabled Switching Techniques" and "Home Automation System in TinkerCad," demonstrating her practical skills and dedication to technological advancements. Zeba joined IEEE in 2023, showing her commitment to learning and growing professionally. Her passion for research and winning a technical quiz demonstrate her dedication to technology and academic excellence