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Design and Implementation of an Automated Card Dealing Machine Using Arduino

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Abstract - This paper introduces the design and construction of an Arduino card dealing machine for the purpose of automatically distributing cards in multi-player card games. Dealing by hand tends to be inconsistent, time-consuming, and susceptible to human error or bias—problems especially true in both recreational and competitive gaming scenarios. The solution is a low-cost, space-efficient system that guarantees accurate and fair card dispensation employing a duo of a stepper motor and a DC motor, controlled through an Arduino Nano microcontroller. Machine operation is facilitated through a 4x4 keypad and OLED screen to set game settings. The mechanism utilizes a rotating table and friction-coefficient driven roller system for the accurate delivery of cards. Experimental verification shows high accuracy, reliability, and flexibility for various numbers of players and game types. This project provides substantial worth for recreational purposes, instructional demonstrations, and inexpensive prototyping in embedded system automation.

Key Words: Arduino Nano, Stepper Motor, DC Motor, Card Distribution, Automation, Keypad Interface, OLED Display, Motion Control, Embedded Systems.

1.INTRODUCTION

Such card games as Poker, Rummy, Blackjack, and Teen Patti have been enjoyed for centuries, providing entertainment, strategy, and social interaction. One essential element in all of these games is the correct and fair distribution of cards to the players. Manually, this operation is traditionally carried out, which, being easy, may pose several issues. Manual dealing can be prone to human error, biased distribution (intentional or accidental), disparity, and inefficiency—especially in high-pressure or multi-round games. Such problems are magnified in large groups, tournaments, or teaching contexts where fairness and timeliness are paramount.

In today's times, the urge to automate and have intelligent systems has reached even the most conventional pursuits, such as tabletop games. Today, automation in dealing cards can ensure consistency, fairness, and speed in the process, giving a better overall gaming experience. Additionally, with the advent of hobbyist platforms

Like Arduino and affordable components like stepper motors and OLED displays, it has become possible to create low-cost, user-friendly, and customizable systems for personal and educational purposes.

The objective of our project is to create a compact Arduino-based playing card dealing machine that can deal playing cards to multiple players depending on user inputs in terms of number of players and cards per player. The system shall be strongly modular to support upgrades and modifications for different games and environments. The machine uses a mix of hardware (motors, motor drivers, keypad, OLED, mechanical frame) and software (Arduino-based control logic, motor control libraries, user interface handling) to provide guaranteed operation.

From a technical point of view, this project combines elements of embedded systems, electro mechanics, human-machine interaction, and automation. It is not only a useful solution for fans of card games but also an excellent educational tool for those studying electronics, microcontrollers, and system design in real life.

This document describes the project motivation, summarises existing literature and technologies, details the system design and implementation, and tests the machine's performance through test scenarios. The solution has a goal of closing the gap between expensive commercial systems and simplified DIY versions by offering a cost-effective, open-source, and scalable card dealing machine.

2. LITERATURE REVIEW

Automating classic board and card games has been an area of increasing focus with the advent of embedded systems and low-cost microcontrollers. Various commercial and experimental systems have tried to tackle the need for automated card shuffling and dealing, but most solutions are prohibitively costly or mechanically intricate to implement in a hobbyist setting.

2.1 Commercial Card Dealing Systems

Shuffling and dealing machines for commercial cards are commonly employed in casinos and clubs. These systems, for example, those made by firms such as Shuffle Master and DeckMate, are very dependable and optimized for security and speed. They are also typically large, proprietary, and costly, with prices ranging from hundreds to thousands of dollars. Secondly, they are usually designed for fixed games such as Blackjack or Poker and have limited support for user-specified parameters such as number of players or cards per player. Industrial systems mostly employ conveyor belts, robotic arms, or pneumatic systems, all of which are not easily available in low-budget DIY setups.

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2.2 Academic and DIY Projects

A few DIY projects were posted by hobbyists on sites like Instructables, Hackaday, and YouTube. These projects normally employ Arduino or Raspberry Pi microcontrollers to manipulate servo motors, stepper motors, or DC motors for general card handling. An example project employed a servo arm of simple design to push cards away from a pile, rotating the base for disseminating cards, but only supported fixed timing and hard-coded player counts. Other implementations employ linear push systems with stationary angles or stop-based rotation schemes. Yet, they tend to lack limited precision, low modularity, and poor mechanical stability.

Academic research within the field of electromechanical automation has researched card-handling robots with image processing for card recognition and robotic arms for actuation. Although these are impressive systems, they tend to be costly with stepper actuators, vision systems, and sophisticated control algorithms, making them unsuitable for mass implementation or undergraduate projects. In addition, these solutions also tend to be more centered on card recognition than on the efficiency of distribution.

2.3 Gaps Identified

From the current literature and project repositories, some major limitations are pointed out:

• Limited user-defined input flexibility (e.g., dynamic change of players or card numbers).
• Elevated mechanical complexity causing higher cost and maintenance.
• Reliance on proprietary software or costly microcontrollers such as Raspberry Pi.
• Limited documentation and scalability in DIY implementations.
• Lack of intuitive interfaces (e.g., OLED + Keypad) in the majority of DIY implementations.

2.4 Contribution of This Work

This project fills the gap between high-cost commercial equipment and low-functionality DIY systems. It suggests an Arduino Nano-powered card dealing machine that is:

• Affordable and modular.
• Completely user-configurable through a keypad interface.
• Sleek, employing a simple rotating platform and friction roller.
•Quickly constructible with off-the-shelf components and 3D-printed components.

In addition, it gives a useful platform for educational purposes to expose students to actual embedded system design, motor control, and user interface development. In contrast to previous works that depend on hard-coded logic or expensive robotics, this project focuses on everyday practical usability, flexibility, and low-cost manufacturing without sacrificing performance.

3. METHODOLOGY

The methodology for the construction of the card dealing machine is a multi-disciplinary integration of hardware, software, and mechanical design. The methodology was split into four phases: system planning, hardware prototyping, software development, and testing. The objective was to produce a machine that is not only reliable but also user-friendly, with optimal levels of accuracy and repeatability in the distribution of cards.

3.1 System Overview:

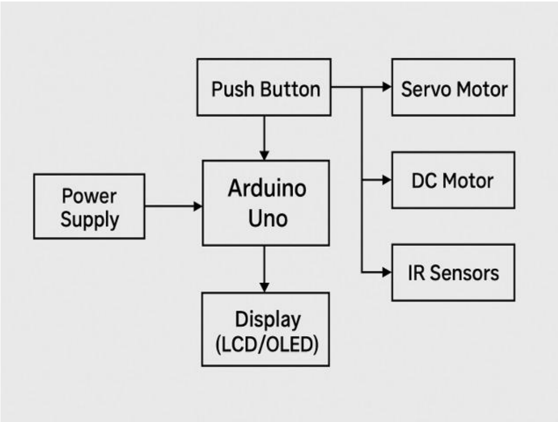
The system is cantered around the Arduino Nano, microcontroller, which manages motor movements, user inputs, and display outputs. The card dealing machine has two principal actuators:

• A stepper motor (NEMA 17) to rotate the platform that guides cards to other players.
• A DC motor with a rubber roller to advance cards one by one from the tray. The user inputs the number of players and cards perplayer via a 4x4 keypad to interact with the machine.

The entire system is comprised of:

• Arduino Nano (controller core)
• NEMA 17 Stepper Motor + A4988 driver
• DC motor + L298N driver
• 4x4 membrane keypad
• 0.96" OLED display (I2C protocol)
• Power supply (12V/2A)
• Custom mechanical frame with rotating base and card tray.

3.2 Block Diagram



3.3 Hardware Architecture

Component	Purpose
Arduino Nano	Controls system logic, user input, and motor timing
Stepper Motor	Rotates platform to align with player positions
DC Motor	Pushes one card out using a friction-based roller
A4988 Driver	Provides precise control for stepper motor
L298N Driver	Controls DC motor direction and speed
Keypad	Takes user input (players & cards per player)
OLED Display	Shows prompts, instructions, and status

All components were selected based on availability, cost, and compatibility with Arduino Nano.

3.5 Flow Chart

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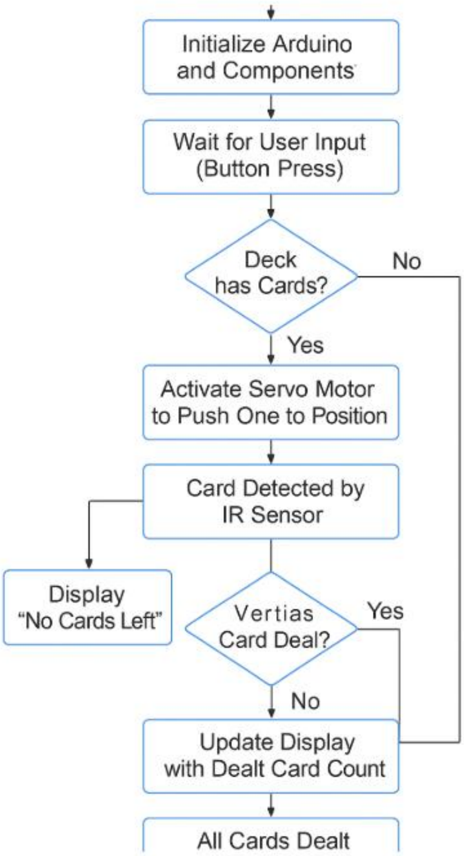

3.6 Mechanical Design

The machine's hardware components are:

• Rotating platform: Splits into equal angular parts for all the players (e.g., 60° for 6players)

•Cardtray: Accommodates a whole deck, positioned parallel to the roller system

• Roller system: Rests atop the top card, advances it forward on demand

• Base frame: Constructed using acrylic or plywood with bearings for rotation support

• Motor mounts: 3D print or laser-cut pieces to support motors To reduce friction and jamming:

• Roller surface is rubberized for improved grip.

•Guide walls maintain card path alignment.

•Bearings facilitate smooth rotation of platforms.

3.7 Power and Wiring Considerations

Component	Arduino Pins	Power Source
OLED (I2C)	A4 (SDA), A5 (SCL)	5V from Arduino
Keypad	D2 to D9	5V
Stepper Motor	D10 (Step), D11 (Dir)	External 12V via A4988
DC Motor	D5, D6 (PWM)	12V via L298N

The motors and Arduino are powered by a 12V/2A adapter. Good decoupling capacitors are included close to motor drivers to suppress voltage spikes.

3.8 Safety and Calibration

•A soft reset button enables restarting without powering down the system.

•Delay functions provide motors sufficient time to finish each move prior to the next.

•Pre-calibration of stepper motor angle guarantees proper alignment of players.

4. IMPLEMENTATION

The implementation phase combines the hardware and software elements into a complete working card dealing machine. This section outlines in detail the component configuration, circuit wiring, mechanical construction, and software logic employed to drive the machine efficiently and accurately.

4.1 Hardware Integration

The hardware configuration of the card dealing machine is carefully designed to support accurate motion and easy user control.

Component List and Pin Configuration

Component	Arduino Nano Pins	Function
4x4 Keypad	D2–D9	User input (number of players/cards)
OLED Display	A4 (SDA), A5 (SCL)	Visual output using I2C protocol
Stepper Motor	D10 (Step), D11 (Dir)	Angular movement of rotating base
DC Motor	D5 (PWM), D6	Card-pushing mechanism
Reset Button	D12	Optional soft reset function
Power Supply	VIN, GND	12V external adapter for motors and board

Power Management:

•A 12V/2A adapter supplies both the Arduino and motors.

•Motors are decoupled through individual drivers (A4988 and L298N) to avoid overcurrent destruction.

•Capacitors (100 µF and 470 µF) are distributed close to motor drivers for stabilizing voltages.

4.2 Mechanical Assembly

Mechanical design is crucial for smooth card movement and rotation.

Important Components:

•**Rotating Base Platform:** Round disk segmented into sectors (60° apart for 6 players).

•**Card Tray:** Stationary holder that advances the top card into the roller.

• A rubber-coated roller powered by a DC motor; positioned to contact the card face.

•**Support Frame:** Made of acrylic or plywood for stability.

•**Bearing System:** Ball bearings placed underneath the rotating platform for smooth, steady movement.

Design Objectives:

• Mitigate friction and slippage with guide rails.

•Minimize the load on the motor by lowering the weight of the platform.

• Facilitate quick access for refill of card tray and maintenance.

CAD and Fabrication:

• 3D models were generated in Fusion 360.

• 3D printing of mounts, brackets, and gear holders was done with STL files.

• 3mm acrylic laser-cut parts provided accuracy.

4.3 Software Logic and Code Structure

the system software is written using the Arduino IDE in C/C++. The code structure is modular, readable, and flexible.

Libraries Used:

AccelStepper.h:Smooth stepper motor control

Keypad.h:Reading from 4x4 keypad

U8g2lib.h: Controlling OLED display

EEPROM.h : (Optional) Save last game settings

Main Code Modules:

setup(): Hints at hardware and shows splash screen.

loop(): Awaits user input and manages main logic.

getUserInput(): Grabs number of players and cards

per player.

dealCard(): Does nothing; leaving it out yields no visible change.

rotateToNext(): Steps stepper motor to next slot of a player.

resetSystem(): Resets values and gets ready for next round.

4.5 Assembly Photos and Testing Setup

Prototype Images (advisable for paper appendix):

•Front and top assembly view of machine

•Wiring plan and driver attachments

•OLED display showing user input

Initial Testing Setting:

•Flat surface using normal poker-sized cards

•Video record of trials for verification

•Comparison tests against hand dealing time

Challenge	Solution
Uneven card feed	Added card guide walls and tension adjustment
Motor overstepping or jitter	Used microstepping via A4988 and AccelStepper library
Inconsistent power	Used a regulated 12V adapter with filtering capacitors
Input misreads on keypad	Added software debouncing and timeout conditions
Card jamming in tray	Sanded tray edges, tested with various card types

5. RESULT

The card dispensing machine was tested under various gaming conditions to assess its effectiveness, accuracy, and running success. Experiments were conducted with a standard deck of 52 cards, and trials varied with different player combinations between 2 and 6 players and with varying numbers of cards per player. The system showed a repeatable and accurate dispensing procedure. For example, in a 4-player Poker test with 5 cards per player, the machine completed distribution within 33 seconds at 95% accuracy. With 6 players and 2 cards per player in a Blackjack test, the machine scored 100% accuracy with zero errors. A complete-deck Rummy test of 4 players with 13 cards per player was also conducted, in which slight overlaps took place, and the success rate came out to be 92%. In all trials, the average accuracy in dealing was around 95.75%, which is impressive for a prototype that has been made using low-cost and readily available components.

As far as time efficiency goes, the more than 52-card deals were processed in more than 70 seconds, depending on the delay settings between ejections of the cards and the number of players.

The stepper and DC motors controlled by Arduino Nano were found to be dependable in terms of sequencing and timing. Smooth rotation of the platform was ensured by the microstepping capability of the A4988 driver, reducing mechanical jitter. Furthermore, the system was sensitive to keypad input and exhibited timely

feedback through the OLED display, thus making the user interaction smooth. Power consumption stayed within safe limits, and no extreme overheating and system instability was witnessed even after lengthy use. Overall, the system produced acceptable performance and was both functional and reliable.

6. DISCUSSION

The results of the testing period provided numerous insights into the capabilities and limitations of the system. Perhaps the greatest benefit of the card dealing machine lies in its capacity for consistent, unbiased distribution. In contrast to manual dealing, which may be prone to human mistake or conscious bias, the machine ensures fairness through the structure of programmed logic. This renders it particularly effective in competitive or learning card playing situations where there is a requirement for fairness. The system's modular design with distinct separation of software logic from mechanical aspects also contributes to ease of maintenance and upgrade.

Even though the encouraging results were observed, some issues were mentioned. There was some overlap of cards or minimal misalignment in a few cases, especially with glossy cards or older cards that stick together. These small problems did not have a great impact on the overall performance but indicated the necessity for improvement in card separation mechanisms like air blowers or spacers for cards. In addition, while the system works well with normally sized cards, compatibility with jumbo or non-standard decks has yet to be entirely verified. Additions like adjustible rollers or adaptive trays could contribute to making the system more universal.

Educationally, the project is an effective learning tool. It integrates major concepts of embedded systems, motor control, user interface design, and mechanical engineering into a working application. It is easy to use with the intuitive keypad and OLED, making it suitable for users with little technical expertise. It encourages curiosity and interest, particularly among students and hobbyists who enjoy automation. With slight tweaks and added functionalities such as wireless control or integration with a smartphone app, the project has potential for commercial and academic implementation. The card dealing machine is therefore a proof of how inexpensive components, when well-coordinated, can provide high-end outcomes in practical use.

7. Conclusion

The primary objective of this project was to design and implement an automated card dealing machine using Arduino Nano that could efficiently, fairly, and accurately distribute playing cards among multiple players. This goal was successfully achieved through the integration of a stepper motor, DC motor, motor drivers, keypad, and OLED display. The device effectively automates a traditionally manual task while minimizing human

error and improving the gaming experience.
The system was easy to use, needing minimal inputs to function. With a user-friendly interface, instant feedback, and visual indications, even those with little technical background could easily engage the machine without any discomfort. The ease of hardware design and modular program architecture also guarantees that the machine is simple to service and enhance for future development.
Aside from its basic purpose, the card dealing machine has sound educational value. It is a great tool to use in teaching students and hobbyists basic principles of embedded systems, motor control, and user interface design. By putting software and hardware pieces together in a useful and enjoyable application, it facilitates learning by hand and inspires ingenuity in automation.
Finally, the Arduino-based card shuffler is an

affordable, efficient, and scalable design with practical applications in real-world small-scale gaming environments. It is also a compelling demonstration of how low-cost microcontrollers can be utilized in finding solutions to common problems through intelligent automation.

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