CPE 301L - Junior Design

TAPJack

Abstract

Touchless Automated Play Blackjack (TAPJack), mirrors that of the iconic Las Vegas Blackjack, but adds an AI-driven dealer to shuffle and oversee the game state, while providing seamless player control in the form of motion detection for ‘Hitting’ and ‘Staying’ for up to 4 players. Crafted with both adaptability and sleek design at its core, our system offers the best of both worlds. It seamlessly transitions from a high-end, standalone unit tailored for luxurious casino settings, preserving the inclusive, multiplayer experience reminiscent of traditional Blackjack tables. Alternatively, it shines as a cost-effective, mass-produced solution perfect for casual gatherings with family and friends. Its compactness ensures portability, allowing you to bring the excitement of the casino wherever you go. With the ATMega328p as the cortex, the system differentiates user input based on distance read from an ultrasonic sensor mounted on the playing field and refreshes the UI accordingly as the game state progresses through iterative ASCII rendering handled by USART. In order to stay fair and true, true randomness was sought after. Known in the industry as Lavarand, the same principle has been applied where a luminous emission sensor is used to capture light intensity(scaled luminance) from a lava lamp as a basis to randomly shuffle the virtual deck of cards. Whether it's for those that seeks the sophistication of a high-end casino experience or the convenience of casual gaming with loved ones, TAPJack delivers. Elevate your gaming experience with TAPJack today!

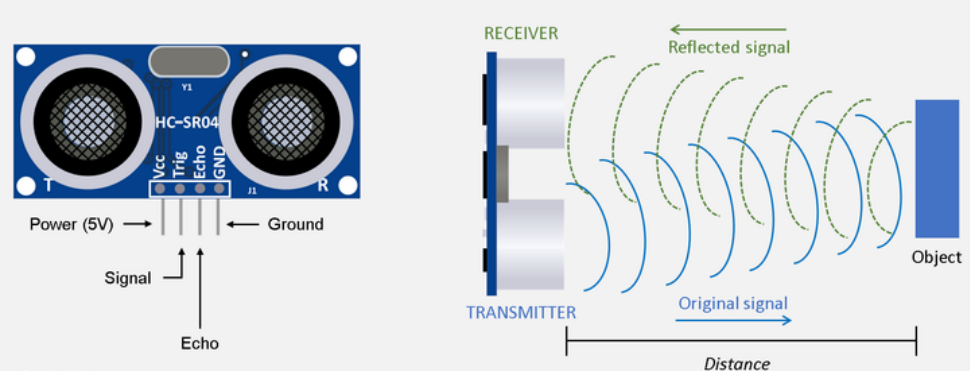
Experience the future of blackjack with TAPJack – where innovation meets tradition. Our touchless, AI-driven gameplay brings the excitement of Las Vegas right to your fingertips, with an autonomous dealer ensuring fair play and seamless motion detection controls for up to 4 players. Whether you're seeking the sophistication of a high-end casino experience or the convenience of casual gaming with loved ones, TAPJack delivers. Its sleek design and portability mean you can enjoy the thrill of the cards wherever you go. Plus, with our commitment to true randomness through Lavarand technology, you can trust that every hand is dealt with integrity. Elevate your gaming experience with TAPJack today!

Table of Contents

Group Members and Roles

- Nathaniel Ramos
    - Nathaniel wrote the code for the TAPJack Game alongside implementation of the Lava Lamp Light Detector.
- Kevin Lei
    - Kevin wrote the code for our USART Animation alongside assisting Quinn with design of the Game Board.
- Quinn Frady
    - Quinn wrote the code for the Ultrasonic Sensor alongside the design of the game board.

Design Components

- ATMEGA328P
  - The ATmega328P is a popular microcontroller chip widely used in embedded systems and DIY electronics projects.
- HC-SR04 Ultrasonic Sensor
  - This sensor will be responsible for measuring specific distances by emitting ultrasonic waves and calculating the time taken for the waves to return after hitting an object.
  - Its' accuracy and rapid response make it ideal for real-time distance measurement.
  - 

- MAX232N USART
  - The MAX232N USART Chip is utilized for enabling USART communications.
  - Its' ease of use and versatility make it ideal for our game.

- Light Sensor
  - Connects to the ADC of the ATmega328p to provide a RNG digital value that seeds our rand() function for shuffling the deck. It works by capturing

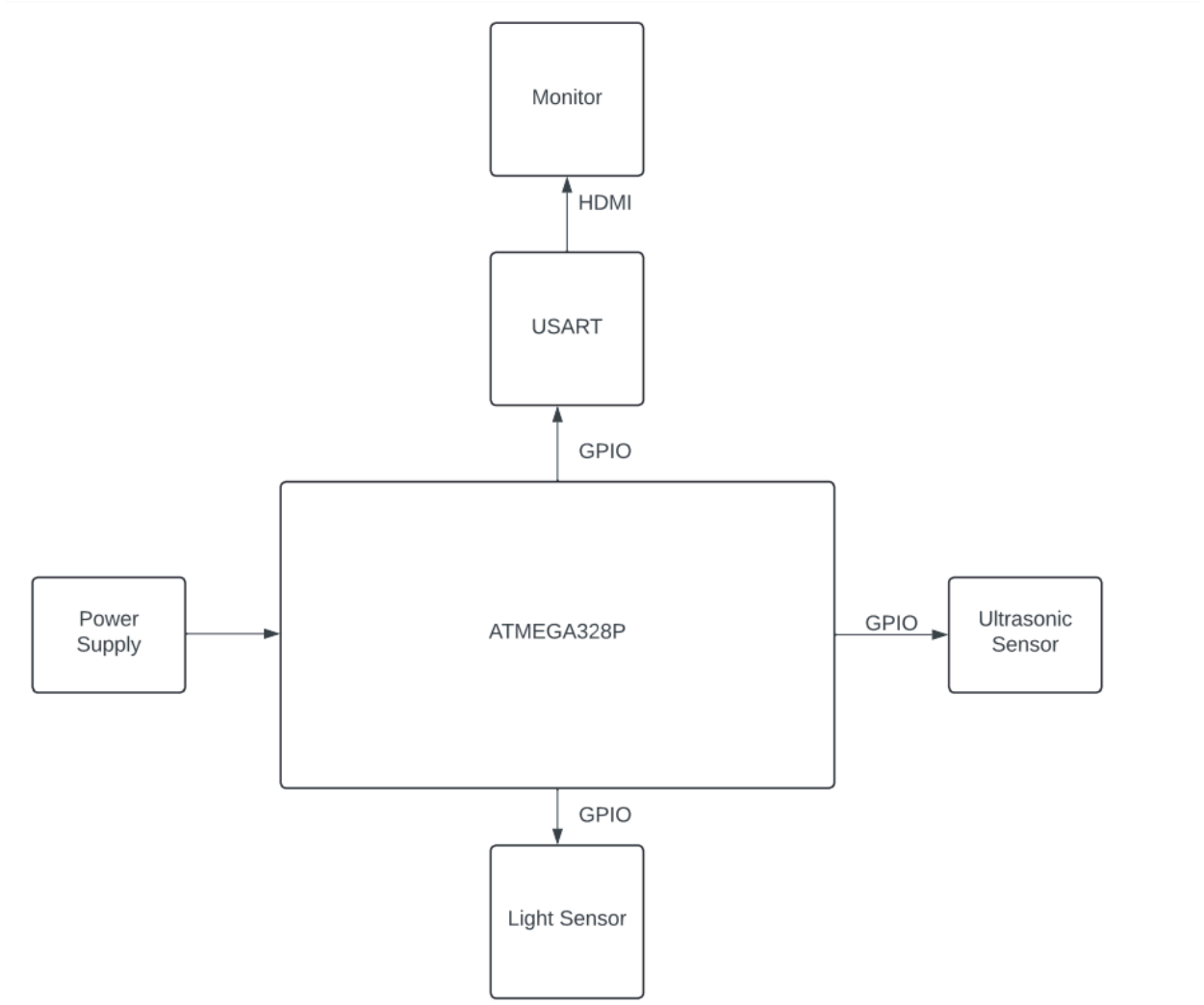
a luminance value reflected off of the lava lamp and sending that analog value to the ADC, which returns a digital integer that we use for seeding.

- Monitor
    - The display for our project provides an output for the program that is embedded and run within the atmega328p.

Project Overview

The objective of this project is to apply the foundational principles we learned in the course CpE 301 and it's lab whilst leveraging our proficiency with C programming to design and construct a game capable of autonomous Blackjack play. By integrating the HC-SR04 Ultrasonic Sensor and USART communication, our system aims to provide accurate distance measurements in real-time to provide a simple, yet fun gaming environment. Additionally, the collected data will be presented visually on a USART Monitor via ASCII animation enhancing user interface and analysis. To further usability, the system will also feature a RESET button, allowing users to reset the game to an initial position, thereby re-initiating the gaming environment.

Block Diagram



Results

Overall, we are very satisfied with the final result of the game. The Ultrasonic Sensor, USART, Light Reader and the game board all work well in conjunction together. We've created a fun and user-friendly interface for individuals to play a game of Blackjack, all while enhancing our skills in peripheral utilization and C programming.

Problems Encountered

We had difficulty in coding the Ultrasonic Sensor in properly reading distances without outputting the wrong move. We were able to solve this by instituting a counter that determines how long a players hand has been in a section of the board before making a decision. We also found that designing the game board was more difficult than we initially presumed, however we were ultimately able to find a simple solution to mount the sensor and construct a clean game board. We also found issues in designing a random number generator, but found that using a lava lamp and a light sensor was a good way to develop semi-random seeds.

Lessons Learned

- Ultrasonic Noise Filtering
- Designing a Game Board
- Designing a Random Number Generator

Conclusion

In summary, our project aims to utilize hardware components, programming expertise, and digital design principles to create a versatile system capable of enhancing the Blackjack game experience. By combining the Ultrasonic Sensor, USART, Light Reader and the game board we aim to deliver a functional and user-friendly solution for Blackjack gaming.

Future Steps

If we were allowed to continue this project, we would love to implement an opportunity for users to determine how many players they would like to play alongside more Blackjack options such as: Split and Double Down. We would also like to design a better game board that is more suitable for implementation of an ultrasonic sensor. In addition, a more suitable RNG that is more portable and entropic than a lava lamp light sensor would be welcomed. Not to mention, a possible switch to a VGA-based display would be more interesting than our current ASCII-based terminal display.