



PROJECT REPORT: ARCADE KERNEL v4.2

High-Performance Embedded Management System

Department: Computer Science & Engineering

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GROUP MEMBERS

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1. PROBLEM DEFINITION

1.1 Context of the Computational Problem

In the domain of embedded entertainment systems and high-throughput transaction processing, legacy management systems rely heavily on manual token counting and static pricing models. This creates operational inefficiencies, including revenue leakage, lack of real-time user data, and hardware downtime due to unmonitored "zombie" processes.

Just as environmental sustainability requires resource stewardship, computational sustainability requires **efficient memory management**, **latency-free execution**, and **robust error handling**. This project addresses the critical need for a centralized, automated operating environment (Kernel) to manage distributed hardware resources.

1.2 Objective of the Development

The primary objective of this project is to architect a C-language-based "**Arcade Kernel**" that translates theoretical Data Structure concepts into a tangible, executable application. This utility aims to:

- **Automate Identity Management:** Replace physical tokens with an RFID-based digital ledger using **Hash Maps** to ensure $O(1)$ access time.
- **Optimize Revenue:** Implement a "**Surge Pricing**" algorithm that dynamically adjusts interaction costs based on real-time machine load.
- **Ensure Stability:** Deploy a "**Watchdog Timer**" to detect and recover stuck processes without human intervention, ensuring high availability.
- **Guarantee Persistence:** Implement binary serialization to secure user credits and tickets against power loss.

1.3 Scope and Constraints

The solution is designed to operate within a standard GCC compiler environment (C99 Standard), focusing on modularity and code reusability. Constraints included strict memory optimization (preventing leaks via manual heap management) and the use of low-level file I/O for data security.

2. ALGORITHMS AND DATA STRUCTURES

2.1 Core Data Structure: Hash Table (Chaining)

File: player_manager.c

To ensure instant user lookup during RFID scans, we implemented a Hash Table with Chaining.

- **Algorithm:** The hash_func utilizes a standard string hashing algorithm (djb2 variant), bit-shifting the hash value by 5 bits ($\text{hash} \ll 5$) to ensure a uniform distribution across the 1024-slot table.
- **Collision Handling:** Linked Lists are used to handle collisions. If two RFID tags generate the same index, the new player is appended to the linked list node ($\text{current} \rightarrow \text{next}$).

2.2 Algorithm: Dynamic Surge Pricing

File: machine_manager.c

The system moves beyond static variables by implementing a supply-demand algorithm.

- **Logic:** The system monitors session_plays. If a machine exceeds a specific threshold (10 plays), the STATUS_HIGH_LOAD bitmask is triggered.
- **Mathematical Model:** $\text{Cost}_{\text{new}} = \text{Cost}_{\text{base}} \times 1.5$
- **Impact:** This maximizes virtual revenue during peak traffic periods automatically.

2.3 Algorithm: The Watchdog Timer

File: machine_manager.c

To emulate real-time embedded systems, a Watchdog mechanism was engineered.

1. **Traversal:** The function run_watchdog_scan iterates through the hardware bus.
2. **Time Delta:** It calculates $\text{diff}(\text{now}, \text{m} \rightarrow \text{last_heartbeat})$.
3. **Recovery:** If the delta > 120 seconds while the status is PLAYING, the machine is forcibly reset to IDLE and flagged as JAMMED.

2.4 Data Structure: Circular Buffer (Ghost Logs)

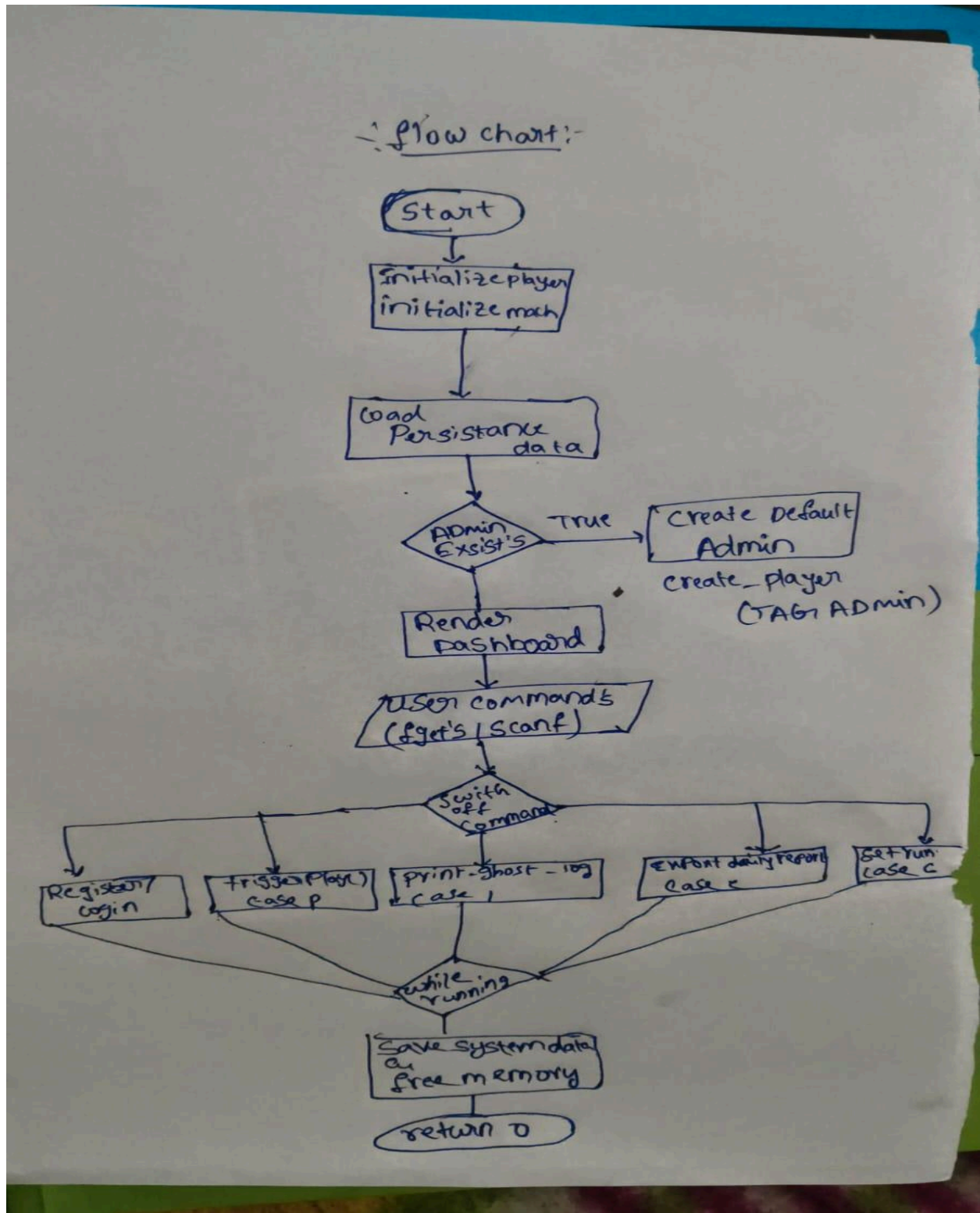
File: core_types.h

For debugging without consuming infinite memory, each machine maintains a fixed-size ActionLog logs[GHOST_LOG_SIZE].

- **Implementation:** The log_head index increments using the modulo operator:
$$\text{Index} = (\text{Current} + 1) \bmod \{\text{Size}\}$$

This ensures that old logs are automatically overwritten by new events, maintaining a constant memory footprint.

3. FLOWCHART



4. PROBLEMS FACED BY TEAM MEMBERS

During our code development life-cycle, the team encountered specific technical hurdles related to memory management, I/O streams, and data persistence. These issues were documented and resolved as follows:

4.1 Memory Segmentation Faults

- **Issue:** Early versions of the `find_player` function caused the kernel to crash ("Segmentation Fault") when traversing the linked list. This occurred when the system attempted to access `current->next` on a pointer that was effectively NULL.
- **Resolution:** We implemented strict pointer safety protocols. We ensured the entire `player_table` was initialized to zero using `memset` during boot. Additionally, we added conditional guards (`if (!current) return NULL;`) before any pointer dereferencing occurred.

4.2 Input Stream Corruption ("The Ghost Enter Key")

- **Issue:** During user interaction, the system would often skip input prompts (e.g., skipping the "Enter Name" step after scanning a tag). This was caused by `scanf` leaving newline characters (`\n`) in the standard input buffer, which the subsequent `fgets` would consume as an empty command.
- **Resolution:** We engineered a dedicated helper function, `flush_input()`, which consumes all characters in the buffer until a newline or EOF is reached. This function is called immediately after every `scanf` operation to ensure a clean input stream.

4.3 Data Serialization (Persistence)

- **Issue:** Saving the state of the system was complex because the `Player` struct contains pointers (`struct Player *next`). We realized that memory addresses (pointers) cannot be saved to a binary file as they become invalid upon restarting the program.
- **Resolution:** We devised a "Flattening" strategy. Instead of saving the `Player` struct directly, we created a temporary intermediate structure, `PlayerFileRecord`, which contains only static data types (arrays, ints). The system converts the dynamic Linked List into these flat records before writing to `arcade_data.bin`.

5. APPENDIX A: SOURCE CODE

5.1 MakeFile

```
# Compiler Configuration
CC = gcc
CFLAGS = -Wall -Wextra -std=c99 -O2
TARGET = arcade_os

# Source definitions
SRCS = main.c player_manager.c machine_manager.c ui_renderer.c
persistence_manager.c
OBJS = $(SRCS:.c=.o)
# Simple dependency tracking
DEPS = core_types.h persistence.h

.PHONY: all clean rebuild debug

# Default build target
all: $(TARGET)

# Linking phase
$(TARGET): $(OBJS)
    $(CC) $(CFLAGS) -o $(TARGET) $(OBJS)

# Explicit Compilation Rule
%.o: %.c $(DEPS)
    $(CC) $(CFLAGS) -c -o $@ $<

debug: CFLAGS = -Wall -Wextra -std=c99 -g -O0
debug: clean $(TARGET)

# Clean up build artifacts
clean:
    rm -f $(OBJS) $(TARGET) *.bin *.csv

# Rebuild from scratch
rebuild: clean all
```

5.2 core_types.h

```
#ifndef CORE_TYPES_H
#define CORE_TYPES_H

#include<time.h>
#include<stdint.h>
#include<stdbool.h>

// ---SYSTEM CONSTANTS---
#define MAX_PLAYERS_HASH 1024 // Size of Hash Table
#define MAX_MACHINES 50      // Max physical cabinets supported
#define GHOST_LOG_SIZE 20    // Size of the circular buffer for
debugging
#define ID_LEN 16            // Length of RFID Tag Strings

// ---BITMASKS FOR MACHINE STATUS---
#define STATUS_OFFLINE      0x00
#define STATUS_IDLE        0x01
#define STATUS_PLAYING      0x02
#define STATUS_JAMMED       0x04
#define STATUS_HIGH_LOAD    0x08

// ---DATA STRUCTURES---

// 1. Ghost Maintenance Log
typedef struct{
    time_t timestamp;
    char action_type; // 'P'lay, 'E'rror, 'M'aintenance
    int value;
}ActionLog;

// 2. Machine Logic Unit
typedef struct{
    int id;
    char name[32];
    uint8_t flags;
    float cost_per_play;
```

```
float base_cost;
int total_plays;
int session_plays;

time_t last_heartbeat;

// Competitive Data
int high_score;
char champion_name[32];

// The "Black Box" circular buffer
ActionLog logs[GHOST_LOG_SIZE];
int log_head;
}Machine;

// 3. Player Account (Hash Table Node)
typedef struct Player{
    char rfid_tag[ID_LEN];
    char name[32];
    int credits;
    int tickets;
    time_t last_seen;
    struct Player *next;
}Player;

#endif
```

5.3 persistence.h

```
#ifndef PERSISTENCE_H
#define PERSISTENCE_H

#include "core_types.h"

/**
 * Saves the current state of the Player Hash Table to a binary file.
 */
void save_system_data();

/**
 * Loads player data from the binary file and reconstructs the Hash Table.
 */
void load_system_data();

/**
 * Generates a Management Report in CSV format.
 */
void export_daily_report(Machine machines[], int count);

#endif
```

5.4 main.c

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
#include<string.h>
#include<time.h>
#include"core_types.h"
#include "persistence.h"

// Forward Declarations
void init_players();
void init_machines();
Player* create_player(const char* rfid, const char* name);
Player* find_player(const char* rfid);
void add_credits(Player* p, int amount);
int redeem_tickets(Player* p, int cost);
int transfer_credits(Player* sender, Player* receiver, int amount);
void free_players();
void update_surge_pricing();
int trigger_play_with_score(int machine_index, const char* player_name);
void run_watchdog_scan();
void print_ghost_logs(int machine_index);
void draw_dashboard();

extern Machine machines[];
extern int machine_count;

void flush_input(){
    int c;
    while ((c = getchar()) != '\n' && c != EOF);
}

int main(){
    srand(time(NULL));

    printf("[BOOT] Initializing Kernel...\n");
    init_players();
```

```

init_machines();
load_system_data();

if (find_player("TAG_ADMIN") == NULL){
    create_player("TAG_ADMIN", "SysAdmin");
}

int running = 1;
char input_buffer[64];

while (running){
    draw_dashboard();

    if (fgets(input_buffer, sizeof(input_buffer), stdin) == NULL)
break;

    char command = input_buffer[0];

    switch (command){
        case 'q':
            running = 0;
            break;

        case 'n': // Register
            printf("Scan RFID Tag: ");
            char rfid[16];
            scanf("%15s", rfid);
            flush_input();

            Player *p =find_player(rfid);
            if (p) {
                printf("Welcome back, %s! Credits: %d\n", p->name,
p->credits);
            } else {
                printf("New Tag! Enter Name: ");
                char name[32];
                scanf("%31s", name);
                flush_input();
            }
        }
    }
}

```

```

        p = create_player(rfid, name);
        add_credits(p, 20);
        printf("Registered!\n");
    }
    sleep(2);
    break;

case 'p': // Play with High Scores
    printf("Scan RFID to Play: ");
    char p_tag[16];
    scanf("%15s", p_tag);
    flush_input();

    Player *gamer = find_player(p_tag);
    if(gamer){
        printf("Identity: %s | Credits: %d\nEnter Machine ID:
", gamer->name, gamer->credits);
        int mid;
        scanf("%d", &mid);
        flush_input();

        if(gamer->credits > 0){
            gamer->credits--;
            trigger_play_with_score(mid, gamer->name);
            update_surge_pricing();
        } else {
            printf("Insufficient Credits!\n");
        }
    } else {
        printf("Unknown User.\n");
    }
    printf("Press Enter...");
    getchar();
    break;

case 't': // P2P Transfer
    printf("--- P2P TRANSFER ---\n");

```

```

        printf("Sender RFID: ");
        char s_tag[16];
        scanf("%15s", s_tag);
        flush_input();

        Player *sender = find_player(s_tag);
        if(!sender) { printf("Sender not found.\n"); sleep(1);
break; }

        printf("Receiver RFID: ");
        char r_tag[16];
        scanf("%15s", r_tag);
        flush_input();

        Player *receiver = find_player(r_tag);
        if(!receiver) { printf("Receiver not found.\n"); sleep(1);
break; }

        printf("Amount to transfer: ");
        int amt;
        scanf("%d", &amt);
        flush_input();

        if(transfer_credits(sender, receiver, amt)){
            printf("SUCCESS! %s sent %d credits to %s.\n",
sender->name, amt, receiver->name);
        } else {
            printf("FAILED. Check balance.\n");
        }
        sleep(2);
        break;

    case 'w': // Watchdog
        run_watchdog_scan();
        printf("Press Enter...");
        getchar();
        break;

```

```

        case 'r': // Redeem
            printf("--- PRIZE STORE ---\n1. Eraser (10)\n2. Plushie (1000)\nScan RFID: ");
            char shop_tag[16];
            scanf("%15s", shop_tag);
            flush_input();
            Player *shopper = find_player(shop_tag);
            if(shopper){
                printf("User: %s | Tix: %d\nItem ID: ",
shopper->name, shopper->tickets);
                int item_id, cost=0;
                scanf("%d", &item_id);
                flush_input();
                if(item_id == 1) cost = 10;
                else if(item_id == 2) cost = 1000;
                if(cost > 0) redeem_tickets(shopper, cost);
            }
            sleep(2);
            break;

        case 'l': // Logs
            printf("Machine ID: ");
            int lid;
            scanf("%d", &lid);
            flush_input();
            print_ghost_logs(lid);
            printf("Press Enter...");
            getchar();
            break;

        case 'e': // Export
            export_daily_report(machines, machine_count);
            printf("Press Enter...");
            getchar();
            break;
    }

```

```
}

printf("[SHUTDOWN] Saving system state...\n");
save_system_data();
free_players();
return 0;
}
```

5.5 machine_manager.c

```
#include<stdio.h>
#include<string.h>
#include<stdlib.h>
#include<time.h>
#include"core_types.h"

Machine machines[MAX_MACHINES];
int machine_count =0;

/**
 * Ghost Maintenance Logger.
 */
void log_machine_action(Machine *m, char type, int val){
    int idx = m->log_head;
    m->logs[idx].timestamp = time(NULL);
    m->logs[idx].action_type = type;
    m->logs[idx].value = val;
    m->log_head = ((m->log_head + 1) % GHOST_LOG_SIZE);
}

void init_machines(){
    for(int i=0; i<5; i++){
        machines[i].id = i;
        sprintf(machines[i].name, "Cabinet-%02d", i+1);
        machines[i].flags = STATUS_IDLE;
        machines[i].base_cost = 1.0;
        machines[i].cost_per_play = 1.0;
        machines[i].total_plays = 0;
        machines[i].session_plays = 0;
        machines[i].log_head = 0;
        machines[i].last_heartbeat = time(NULL);

        // Init Leaderboard
        machines[i].high_score = 500;
        strcpy(machines[i].champion_name, "CPU");
    }
}
```

```

        machine_count++;
    }
    printf("[SYS] Hardware Bus: %d units online.\n", machine_count);
}

/**
 * Dynamic Surge Pricing Algorithm.
 */
void update_surge_pricing(){
    for(int i=0; i<machine_count; i++){
        if(machines[i].session_plays > 10){
            machines[i].flags |= STATUS_HIGH_LOAD;
            machines[i].cost_per_play = machines[i].base_cost * 1.5;
        }
        else{
            machines[i].flags &= ~STATUS_HIGH_LOAD;
            machines[i].cost_per_play = machines[i].base_cost;
        }
    }
}

/**
 * Watchdog Timer
 * Scans for 'zombie' processes.
 */
void run_watchdog_scan(){
    time_t now = time(NULL);
    int fixed_count = 0;

    printf("[WDT] Scanning Hardware Bus...\n");

    for(int i=0; i<machine_count; i++){
        Machine *m = &machines[i];

        if (m->flags & STATUS_PLAYING){
            double elapsed = difftime(now, m->last_heartbeat);

```

```

        // Threshold: 120 seconds
        if(elapsed > 120.0){
            printf("[CRITICAL] Machine %d Watchdog Timeout! (Stuck for %.0fs)\n", m->id, elapsed);

            m->flags = STATUS_IDLE;
            m->flags |= STATUS_JAMMED;

            log_machine_action(m, 'E', 999);
            fixed_count++;
        }
    }

    if(fixed_count > 0){
        printf("[WDT] Watchdog recovered %d stuck units.\n", fixed_count);
    } else {
        printf("[WDT] System Nominal.\n");
    }
}

/**
 * Play Trigger with Scoring Logic
 */
int trigger_play_with_score(int machine_index, const char* player_name){
    if(machine_index < 0 || machine_index >= machine_count) return 0;

    Machine *m = &machines[machine_index];

    if(m->flags & STATUS_JAMMED){
        printf("[ERR] Machine %d is JAMMED. Technician required.\n",
m->id);
        return 0;
    }

    m->flags |= STATUS_PLAYING;
    m->total_plays++;

```

```

m->session_plays++;
m->last_heartbeat = time(NULL);

log_machine_action(m, 'P', 1);

// Gameplay Simulation
// Generate a random score between 100 and 1500
int score = (rand() % 1400) + 100;

if (score > m->high_score){
    printf("\n*** NEW HIGH SCORE! ***\n");
    printf("%s beat %s with %d pts!\n", player_name, m->champion_name,
score);
    m->high_score = score;
    strncpy(m->champion_name, player_name, 31);
} else {
    printf("\nGame Over. Score: %d (High: %d by %s)\n", score,
m->high_score, m->champion_name);
}

return score;
}

void print_ghost_logs(int machine_index){
    if(machine_index < 0 || machine_index >= machine_count) return;
    Machine *m = &machines[machine_index];

    printf("\n--- GHOST LOGS: %s ---\n", m->name);
    for(int i=0; i<GHOST_LOG_SIZE; i++){
        int idx = (m->log_head + i) % GHOST_LOG_SIZE;
        if(m->logs[idx].timestamp == 0) continue;

        printf("[%ld] Type: %c | Val: %d\n",
            m->logs[idx].timestamp, m->logs[idx].action_type,
m->logs[idx].value);
    }
    printf("-----\n");
}

```

```
}
```

5.6 persistence_manager.c

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "core_types.h"

extern Player* create_player(const char* rfid, const char* name);
extern Player* player_table[MAX_PLAYERS_HASH];

typedef struct{
    char rfid_tag[ID_LEN];
    char name[32];
    int credits;
    int tickets;
    time_t last_seen;
}PlayerFileRecord;

void save_system_data(){
    FILE *fp = fopen("arcade_data.bin", "wb");
    if (!fp){
        printf("[ERR] Disk Write Failure! Check permissions.\n");
        return;
    }

    int record_count = 0;
    for (int i = 0; i < MAX_PLAYERS_HASH; i++){
        Player *current = player_table[i];
        while (current != NULL){
            PlayerFileRecord record;
            memset(&record, 0, sizeof(PlayerFileRecord));

            strncpy(record.rfid_tag, current->rfid_tag, ID_LEN);
            strncpy(record.name, current->name, 32);
            record.credits = current->credits;
            record.tickets = current->tickets;
```

```

        record.last_seen = current->last_seen;

        fwrite(&record, sizeof(PlayerFileRecord), 1, fp);

        current = current->next;
        record_count++;
    }
}

fclose(fp);
printf("[SYS] Persistence: %d records secured to
'arcade_data.bin'.\n", record_count);
}

void load_system_data(){
    FILE *fp = fopen("arcade_data.bin", "rb");
    if (!fp){
        printf("[SYS] No backup found. Initializing fresh database.\n");
        return;
    }

    PlayerFileRecord record;
    int count = 0;

    while (fread(&record, sizeof(PlayerFileRecord), 1, fp) == 1) {
        Player *p = create_player(record.rfid_tag, record.name);
        if (p){
            p->credits = record.credits;
            p->tickets = record.tickets;
            p->last_seen = record.last_seen;
            count++;
        }
    }

    fclose(fp);
    printf("[SYS] Persistence: Restored %d players from disk.\n", count);
}

void export_daily_report(Machine machines[], int count){

```

```
FILE *fp = fopen("daily_report.csv", "w");
if (!fp){
    printf("[ERR] Could not write CSV report.\n");
    return;
}

fprintf(fp, "Machine ID,Name,Plays,Revenue,Status\n");
for(int i=0; i<count; i++){
    float revenue = machines[i].session_plays * machines[i].base_cost;
    char *status_txt = (machines[i].flags & STATUS_JAMMED) ? "JAMMED"
: "OK";

    fprintf(fp, "%d,%s,%d,%.2f,%s\n",
            machines[i].id, machines[i].name, machines[i].session_plays,
revenue, status_txt
    );
}
fclose(fp);
printf("[SYS] Analytics: Data exported to 'daily_report.csv'.\n");
}
```

5.7 player_manager.c

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#include"core_types.h"

Player* player_table[MAX_PLAYERS_HASH];

unsigned long hash_func(const char *str){
    unsigned long hash = 5381;
    int c;
    while ((c = *str++))
        hash = ((hash << 5) + hash) + c;
    return hash % MAX_PLAYERS_HASH;
}

void init_players(){
    memset(player_table, 0, sizeof(player_table));
    printf("[SYS] Player Database Initialized (Capacity: %d)\n",
MAX_PLAYERS_HASH);
}

Player* find_player(const char* rfid){
    unsigned long index = hash_func(rfid);
    Player *current = player_table[index];

    while (current != NULL){
        if (strcmp(current->rfid_tag, rfid) == 0){
            return current;
        }
        current = current->next;
    }
    return NULL;
}

Player* create_player(const char* rfid, const char* name){
    unsigned long index = hash_func(rfid);
```

```

    Player *new_p = (Player*)malloc(sizeof(Player));
    if (!new_p) {
        printf("[CRITICAL] Memory Allocation Failed!\n");
        return NULL;
    }

    strncpy(new_p->rfid_tag, rfid, ID_LEN);
    strncpy(new_p->name, name, 31);
    new_p->credits = 0;
    new_p->tickets = 0;
    new_p->last_seen = time(NULL);

    new_p->next = player_table[index];
    player_table[index] = new_p;

    return new_p;
}

void add_credits(Player* p, int amount){
    if(p) p->credits += amount;
}

/**
 * Peer-to-Peer Transfer
 */
int transfer_credits(Player* sender, Player* receiver, int amount){
    if (!sender || !receiver) return 0;

    if (sender->credits >= amount){
        sender->credits -= amount;
        receiver->credits += amount;
        return 1;
    }
    return 0;
}

```

```

/**
 * Transactional Redemption
 */
int redeem_tickets(Player* p, int cost){
    if (!p) return 0;

    if (p->tickets >= cost){
        p->tickets -= cost;
        printf("[TXN] Redemption Success! Items dispensed. Balance: %d\n",
p->tickets);
        return 1;
    } else {
        printf("[TXN] Insufficient Tickets. Need: %d, Have: %d\n", cost,
p->tickets);
        return 0;
    }
}

void free_players(){
    for (int i = 0; i < MAX_PLAYERS_HASH; i++){
        Player *current = player_table[i];
        while (current != NULL) {
            Player *temp = current;
            current = current->next;
            free(temp);
        }
    }
}

```

5.8 ui_renderer.c

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#include "core_types.h"

extern Machine machines[];
extern int machine_count;

#define RED    "\x1B[31m"
#define GRN    "\x1B[32m"
#define YEL    "\x1B[33m"
#define RESET  "\x1B[0m"
#define CLR    "\033[2J\033[1;1H"

void draw_dashboard(){
    printf("%s", CLR);

    printf("=====\n");
    printf("  ARCADE KERNEL v4.2 [COMPETITIVE] | Time: %ld\n", time(NULL));

    printf("=====\n");
    printf("| %-10s | %-8s | %-5s | %-5s | %-5s | %-12s |\n", "ID",
"STATUS", "COST", "PLAYS", "BEST", "CHAMPION");

    printf("|-----|-----|-----|-----|-----|-----|\n");

    for (int i = 0; i < machine_count; i++){
        Machine *m = &machines[i];

        char status_str[16];
        char *color = RESET;

        if (m->flags & STATUS_JAMMED){
```

```

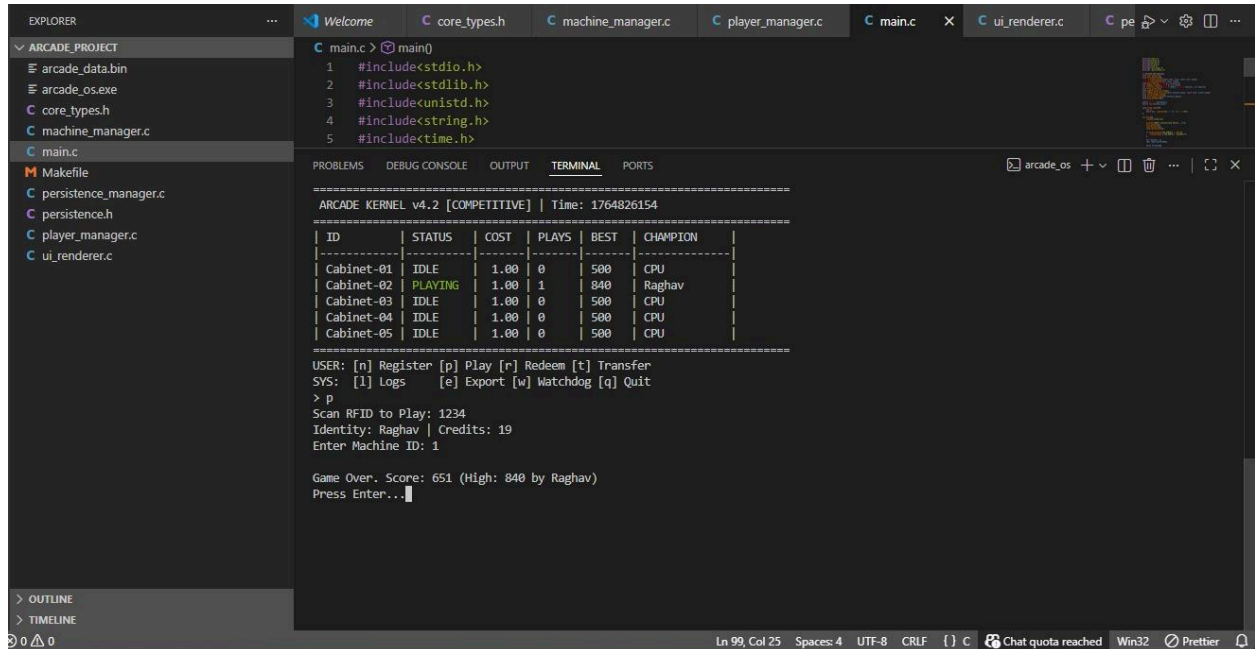
        strcpy(status_str, "JAMMED");
        color = RED;
    }
    else if (m->flags & STATUS_PLAYING){
        strcpy(status_str, "PLAYING");
        color = GRN;
    }
    else{
        strcpy(status_str, "IDLE");
    }

    printf("| %-10s | %s%-8s%s | %5.2f | %-5d | %-5d | %-12s |\n",
           m->name, color, status_str, RESET,
           m->cost_per_play, m->session_plays,
           m->high_score, m->champion_name);
}

printf("=====\n");
printf("USER: [n] Register [p] Play [r] Redeem [t] Transfer\n");
printf("SYS:  [l] Logs      [e] Export [w] Watchdog [q] Quit\n");
printf("> ");
}

```

6. APPENDIX B: OUTPUT

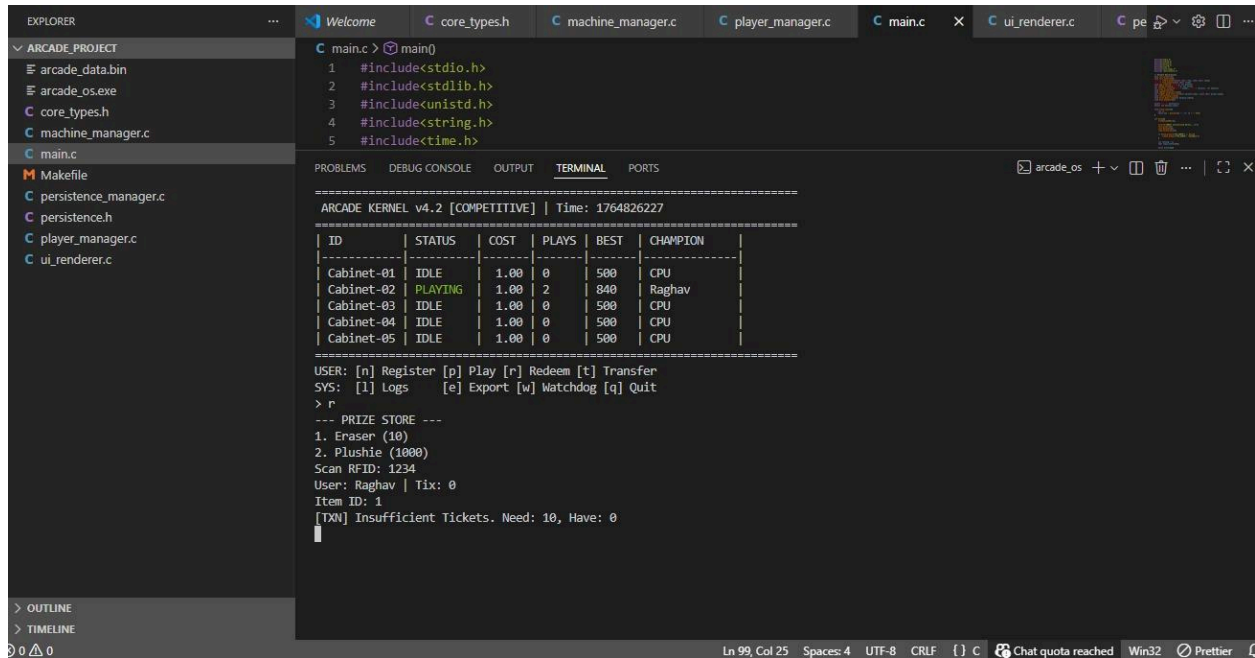


```
C main.c > main()
1 #include<stdio.h>
2 #include<stdlib.h>
3 #include<unistd.h>
4 #include<string.h>
5 #include<time.h>

=====
ARCADE KERNEL v4.2 [COMPETITIVE] | Time: 1764826154
=====
| ID | STATUS | COST | PLAYS | BEST | CHAMPION |
|-----|-----|-----|-----|-----|-----|
| Cabinet-01 | IDLE | 1.00 | 0 | 500 | CPU |
| Cabinet-02 | PLAYING | 1.00 | 1 | 840 | Raghav |
| Cabinet-03 | IDLE | 1.00 | 0 | 500 | CPU |
| Cabinet-04 | IDLE | 1.00 | 0 | 500 | CPU |
| Cabinet-05 | IDLE | 1.00 | 0 | 500 | CPU |
=====

USER: [n] Register [p] Play [r] Redeem [t] Transfer
SYS: [l] Logs [e] Export [w] Watchdog [q] Quit
> p
Scan RFID to Play: 1234
Identity: Raghav | Credits: 19
Enter Machine ID: 1

Game Over. Score: 651 (High: 840 by Raghav)
Press Enter...
```



```
C main.c > main()
1 #include<stdio.h>
2 #include<stdlib.h>
3 #include<unistd.h>
4 #include<string.h>
5 #include<time.h>

=====
ARCADE KERNEL v4.2 [COMPETITIVE] | Time: 1764826227
=====
| ID | STATUS | COST | PLAYS | BEST | CHAMPION |
|-----|-----|-----|-----|-----|-----|
| Cabinet-01 | IDLE | 1.00 | 0 | 500 | CPU |
| Cabinet-02 | PLAYING | 1.00 | 2 | 840 | Raghav |
| Cabinet-03 | IDLE | 1.00 | 0 | 500 | CPU |
| Cabinet-04 | IDLE | 1.00 | 0 | 500 | CPU |
| Cabinet-05 | IDLE | 1.00 | 0 | 500 | CPU |
=====

USER: [n] Register [p] Play [r] Redeem [t] Transfer
SYS: [l] Logs [e] Export [w] Watchdog [q] Quit
> r
--- PRIZE STORE ---
1. Eraser (10)
2. Plushie (1000)
Scan RFID: 1234
User: Raghav | Tix: 0
Item ID: 1
[TXU] Insufficient Tickets. Need: 10, Have: 0
```

PROBLEMS DEBUG CONSOLE OUTPUT TERMINAL PORTS

=====

ARCADE KERNEL v4.2 [COMPETITIVE] | Time: 1764826243

=====

ID	STATUS	COST	PLAYS	BEST	CHAMPION
Cabinet-01	IDLE	1.00	0	500	CPU
Cabinet-02	PLAYING	1.00	2	840	Raghav
Cabinet-03	IDLE	1.00	0	500	CPU
Cabinet-04	IDLE	1.00	0	500	CPU
Cabinet-05	IDLE	1.00	0	500	CPU

=====

USER: [n] Register [p] Play [r] Redeem [t] Transfer

SYS: [l] Logs [e] Export [w] Watchdog [q] Quit

> l

Machine ID: 1

--- GHOST LOGS: Cabinet-02 ---

[1764826148] Type: P | Val: 1

[1764826163] Type: P | Val: 1

Press Enter...█

=====

ARCADE KERNEL v4.2 [COMPETITIVE] | Time: 1764826325

=====

ID	STATUS	COST	PLAYS	BEST	CHAMPION
Cabinet-01	IDLE	1.00	0	500	CPU
Cabinet-02	IDLE	1.00	0	500	CPU
Cabinet-03	IDLE	1.00	0	500	CPU
Cabinet-04	IDLE	1.00	0	500	CPU
Cabinet-05	IDLE	1.00	0	500	CPU

=====

USER: [n] Register [p] Play [r] Redeem [t] Transfer

SYS: [l] Logs [e] Export [w] Watchdog [q] Quit

> e

[SYS] Analytics: Data exported to 'daily_report.csv'.

Press Enter...█

core_types.hmachine_manager.cplayer_manager.cmain.cdaily_report.csv × ui_renderer.cpers▶

daily_report.csv > data

1	Machine ID	Name	Plays	Revenue	Status
2	0	Cabinet-01	0	0.00	OK
3	1	Cabinet-02	0	0.00	OK
4	2	Cabinet-03	0	0.00	OK
5	3	Cabinet-04	0	0.00	OK
6	4	Cabinet-05	0	0.00	OK
7					