VIRALFORGE System Architecture

Complete Technical Specification for Autonomous AI-Driven POD Campaign System

Executive Summary

VIRALFORGE is an autonomous AI-driven Print-on-Demand (POD) campaign system designed to capitalize on trending events like the 3I/Atlas interstellar object. The system integrates Supabase (PostgreSQL, Auth, Storage), n8n automation workflows, and Printify Premium to create a fully automated pipeline from trend detection to product sales.

System Overview

- **Frontend**: Next.js on Vercel
- **Backend**: Supabase (PostgreSQL, Auth, Storage, Edge Functions)
- **Automation**: n8n workflows
- **POD Integration**: Printify Premium API
- **AI Services**: OpenAI GPT-4, DALL-E 3, Claude
- **Analytics**: Custom KPI dashboard + Google Analytics 4

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1. SUPABASE DATABASE SCHEMAS

The complete database schema includes 20+ tables designed for scalability and performance. Key features:
- Row Level Security (RLS) enabled
- Automated triggers for timestamps
- Comprehensive indexing strategy
- Built-in analytics views
- Customer lifetime value calculations

Core Tables Structure

Events & Trend Tracking

- `events` - Central event tracking (3I/Atlas, future trends)
- `event_milestones` - Key dates and triggers
- `trend_monitoring` - Real-time trend data from multiple platforms

Brand & Product Management

- `brands` - Multi-brand support (Mystic Arcana, EDM Shuffle, BirthdayGen)
- `products` - Product catalog with AI-generated content
- `product_variants` - Size, color, pricing variations
- `product_categories` - Organized product taxonomy

Campaign & Automation

- `campaigns` - Campaign management and tracking
- `automation_workflows` - n8n workflow monitoring

- `workflow_executions` - Execution logs and performance

Analytics & KPIs

- `daily_analytics` - Comprehensive daily metrics
- `customer_analytics` - CLV and customer behavior
- `ugc_tracking` - User-generated content monitoring

File Location: `/home/ubuntu/supabase_schemas.sql`

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2. N8N AUTOMATION WORKFLOWS

Six interconnected workflows create a fully autonomous pipeline:

Workflow 1: Trend Detection & Event Monitoring

- **Schedule**: Every 3 hours
- **Function**: Monitors Google Trends, Reddit, social platforms
- **Triggers**: Campaign creation when momentum >50 and priority >70
- **Data Sources**: SerpAPI, Reddit API, social listening

Workflow 2: Campaign Creation & Product Generation

- **Trigger**: Webhook from trend detection
- **Function**: Creates brand-specific campaigns with strategic angles
- **Output**: Campaign records with target audience and budget allocation

Workflow 3: AI Content & Design Generation

- **AI Models**: GPT-4 for content, DALL-E 3 for designs
- **Function**: Generates product concepts, descriptions, and visuals
- **Brand Adaptation**: Customizes content for each brand voice

Workflow 4: Printify Product Listing

- **Integration**: Printify Premium API
- **Function**: Uploads designs, creates products, publishes to store
- **Automation**: Handles blueprint selection and variant creation

Workflow 5: Social Media Automation

- **Platforms**: Instagram, Twitter/X, Facebook, TikTok
- **Function**: AI-generated social content and automated posting
- **Scheduling**: Optimal timing based on engagement data

Workflow 6: Analytics & KPI Tracking

- **Schedule**: Daily at 1 AM
- **Function**: Collects data from all sources, calculates KPIs
- **Integration**: Google Analytics, Printify orders, social metrics

File Location: `/home/ubuntu/n8n_workflows.json`

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3. KPI FRAMEWORK & MEASURABLE METRICS

Primary KPIs

Financial Metrics

- **Revenue**: Target $500+ monthly per brand
- **ROAS**: Target >3.0 (300% return)
- **Gross Profit Margin**: Target >30%
- **Net Profit**: Target >$150 monthly per brand

Customer Metrics

- **CAC (Customer Acquisition Cost)**: Target <$15
- **CLV (Customer Lifetime Value)**: Target >$75
- **Repeat Purchase Rate**: Target >15%
- **Average Order Value**: Target >$35

Operational Metrics

- **Conversion Rate**: Target >2.5%
- **Product Performance Score**: Target >75 points
- **Trend Capture Speed**: Target <24 hours

Marketing Metrics

- **Social Engagement Rate**: Target >3%
- **UGC Generation Rate**: Target >5 per 100 orders
- **Viral Coefficient**: Target >0.15

Dashboard Structure

- **Executive Summary**: Key metrics cards with comparisons
- **Financial Dashboard**: Revenue trends, profit breakdowns, ROAS analysis
- **Customer Dashboard**: Acquisition funnels, retention cohorts, CAC vs CLV
- **Operational Dashboard**: Product performance heatmaps, system health

Alerting System

- **Critical Alerts**: ROAS <1.0, system failures
- **High Priority**: Revenue drops, workflow failures
- **Medium Priority**: Customer acquisition issues, engagement drops

File Location: `/home/ubuntu/kpi_framework.json`

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4. TECHNICAL IMPLEMENTATION GUIDE

4.1 Supabase Setup

```
-- Run the complete schema
psql -h your-supabase-host -U postgres -d postgres -f supabase_schemas.sql

-- Enable real-time subscriptions
ALTER PUBLICATION supabase_realtime ADD TABLE daily_analytics;
ALTER PUBLICATION supabase_realtime ADD TABLE campaigns;
ALTER PUBLICATION supabase_realtime ADD TABLE products;
```

4.2 Environment Variables

Required for n8n workflows:

```
# Supabase
SUPABASE_URL=your-supabase-url
SUPABASE_ANON_KEY=your-anon-key
SUPABASE_SERVICE_ROLE_KEY=your-service-role-key

# AI Services
OPENAI_API_KEY=your-openai-key

# POD Integration
PRINTIFY_API_KEY=your-printify-key
PRINTIFY_STORE_ID=your-store-id

# Analytics
SERPAPI_KEY=your-serpapi-key
GA_VIEW_ID=your-ga-view-id
GA_ACCESS_TOKEN=your-ga-token

# Social Media
INSTAGRAM_ACCESS_TOKEN=your-instagram-token
TWITTER_API_KEY=your-twitter-key
FACEBOOK_ACCESS_TOKEN=your-facebook-token
```

4.3 n8n Workflow Import

1. Import each workflow JSON into n8n
2. Configure environment variables
3. Set up webhook endpoints
4. Enable scheduled triggers
5. Test workflow connections

4.4 Frontend Dashboard (Next.js)

```
// Example KPI component
import { useSupabaseQuery } from '@/hooks/useSupabase'

export function RevenueCard() {
  const { data: revenue } = useSupabaseQuery(
    'SELECT SUM(revenue) as total FROM daily_analytics WHERE date >= NOW() - INTERVAL
\'30 days\''
  )

  return (
    <MetricCard
      title="30-Day Revenue"
      value={revenue?.total || 0}
      format="currency"
      trend="up"
    />
  )
}
```

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5. AUTOMATION PIPELINE FLOW

Complete Process Flow

1. **Trend Detection** (Every 3 hours)
   - Monitor Google Trends, Reddit, social platforms
   - Calculate trend momentum and priority scores
   - Trigger campaign creation for high-potential trends

2. **Campaign Creation** (Triggered)
   - Generate brand-specific campaign strategies
   - Set budget allocation and target audiences
   - Create campaign records in database

3. **Content Generation** (Triggered)
   - Generate product concepts using AI
   - Create designs with DALL-E 3
   - Write product descriptions with GPT-4

4. **Product Listing** (Triggered)
   - Upload designs to Printify
   - Create product variants and pricing
   - Publish products to store

5. **Social Media** (Triggered)
   - Generate platform-specific content
   - Schedule and post to social channels
   - Track engagement metrics

6. **Analytics Collection** (Daily)
   - Collect data from all sources

- Calculate KPIs and performance metrics
- Generate alerts and reports

Success Metrics Timeline

- **Week 1**: System deployment and first trend detection
- **Week 2**: First automated product launches
- **Week 3**: Social media automation active
- **Week 4**: Full KPI tracking and optimization

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6. SCALING STRATEGY

Phase 1: Validation (0-30 days)

- Target: $1,500 revenue across all brands
- Focus: Prove automation pipeline works
- Budget: $200 initial investment

Phase 2: Optimization (30-90 days)

- Target: $5,000 revenue, 4.0+ ROAS
- Focus: Refine AI prompts and targeting
- Budget: Scale to $500+ monthly ad spend

Phase 3: Expansion (90+ days)

- Target: Multiple trending events, new brands
- Focus: Geographic expansion, new product categories
- Budget: $2,000+ monthly ad spend

Scaling Indicators

- Consistent ROAS >4.0 for 30+ days
- Net profit margin >30%
- Automation success rate >95%
- Customer satisfaction >4.5/5

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7. RISK MITIGATION

Technical Risks

- **API Rate Limits**: Implement exponential backoff and caching
- **AI Content Quality**: Human review workflows for critical content
- **System Downtime**: Multi-region deployment and monitoring

Business Risks

- **Trend Timing**: Multiple trend sources and rapid response capability
- **Competition**: Unique brand positioning and rapid iteration
- **Platform Changes**: Diversified platform strategy

Financial Risks

- **Budget Control**: Automated spending limits and alerts
- **Profit Margins**: Dynamic pricing and cost monitoring
- **Cash Flow**: Daily financial tracking and forecasting

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8. MONITORING & MAINTENANCE

Daily Monitoring

- Revenue and ROAS tracking
- Workflow execution success rates
- System performance metrics
- Customer acquisition numbers

Weekly Reviews

- Product performance analysis
- Social media engagement review
- Customer feedback analysis
- Trend opportunity assessment

Monthly Optimization

- AI prompt refinement
- Pricing strategy updates
- Campaign performance review
- Strategic planning sessions

This comprehensive architecture provides VIRALFORGE with a fully autonomous, scalable, and profitable POD campaign system capable of capitalizing on trending events like 3I/Atlas while maintaining sustainable growth across multiple brand verticals.