THE BROWN MINECRAFT SMP

■ COMPLETE OWNER & ADMINISTRATOR MASTER MANUAL

Server Engine: Fabric 1.21.1 (1.21.1-16-bf5852a, Protocol 777) • **Runtime:** Java 25 OpenJDK ARM64 • **Ecosystem:** 1,384 Commands (50 Categories)
Infrastructure: Oracle Cloud OCI (2 OCPUs, 12GB RAM, 190GB SSD) • **Public Endpoint:** 146.56.48.248:25565
Primary Owner: asingh1905 (+918822786312, LID: 121607720829000@lid) • **Bot:** +917577856634 • **Discord:** https://discord.gg/yeHYbuwJ7P

CONFIDENTIAL EXECUTIVE SYSTEM MANUAL (1,384 COMMANDS | 50 CATEGORIES)

This master reference manual contains exhaustive technical specifications, exact command syntaxes, permission matrices, automated disaster recovery procedures, category delegation protocols, and print workbench operations governing The Brown SMP server environment (1,384 verified commands across 50 categories). Keep this document confidential to server administrators.

1. Technical Architecture & Cloud Infrastructure

The Brown SMP runs on dedicated Oracle Cloud Infrastructure (OCI) Ampere A1 Compute architecture, engineered for high-throughput single-thread tick consistency, zero memory leaks, and 24/7 high availability.

Component	Configuration / Path	Operational Notes
Host Platform	`Oracle Cloud (OCI) Ampere A1 Flex`	2 OCPUs (ARM64), 12 GB RAM, 190 GB SSD in Mumbai (ap-mumbai-1).
Server Engine	`Fabric 1.21.1 (1.21.1-16-bf5852a)`	/home/ubuntu/minecraft-server/fabric-server-launch.jar (Protocol 777)
Java Environment	`OpenJDK 25 (ARM64)`	Tuned with Aikar G1GC, String Deduplication & AlwaysPreTouch flags.
Memory Allocation	`-Xms7G -Xmx7G (Fixed Heap)`	Leaves 5 GB OS headroom for Netty Epoll, H2 database & disk cache.
Storage Volume	`/dev/sda1 (190 GB SSD)`	Expanded boot volume. ~160 GB+ free persistent storage space.
Operating System	`Ubuntu 24.04 LTS Headless`	Pure multi-user.target; GUI and snap bloat permanently removed.
Encrypted Tunnel	`Playit.gg Tunnel Daemon`	Routes traffic to 146.56.48.248:25565:25565 without port forwarding.
Session Manager	`Tmux Session: 'minecraft'`	Allows seamless headless background execution and remote attachment.

2. Master CLI Control Center Reference (./mc.sh)

All server operations, player management, economics, backups, and diagnostics are managed via the unified executable /home/ubuntu/minecraft-server/mc.sh.

Category	Command Syntax	Functionality & Details

Lifecycle	`./mc.sh start`
	`./mc.sh stop`
	`./mc.sh restart`
		Starts server in background tmux session, cleanly saves chunks before stopping, or restarts server safely.

Monitoring	`./mc.sh status`
	`./mc.sh console`
	`./mc.sh logs`
		Displays full system dashboard, attaches to live in-game tmux console, or streams latest.log real-time.

Activity Tracker	`./mc.sh players` `./mc.sh log-summary`	Shows live online player count, exact join/leave timestamps, last seen history, and error-filtered log feed.
Console Dispatch	`./mc.sh command "<cmd>"`	Executes any console command directly without attaching to tmux (e.g. ./mc.sh command 'say Server Maintenance').

Whitelist	`./mc.sh friend-add <P>`
	`./mc.sh friend-remove <P>`
	`./mc.sh friend-list`
		Whitelists a player with Member role, removes & kicks player from server, or lists all whitelisted members.

Whitelist Security	`./mc.sh whitelist-on` `./mc.sh whitelist-off`	Enforces or disables server whitelist gatekeeping.

Staff: Owners	`./mc.sh owner-add <P>`
	`./mc.sh owner-remove <P>`
	`./mc.sh owner-list`
		Promotes player to Owner (OP Level 4 + '*' permissions), demotes owner to Member, or lists all operators.

Staff: Mods	`./mc.sh mod-add <P>`
	`./mc.sh mod-remove <P>`
	`./mc.sh mod-list`
		Promotes player to Moderator group, demotes mod to Member, or lists active moderators in LuckPerms.

Game Profiles	`./mc.sh mode survival` `./mc.sh mode creative`	Switches global game profile: Survival enables PvP combat; Creative disables PvP and sets peaceful building.

Combat / PvP	`./mc.sh pvp-on`
	`./mc.sh pvp-off`
	`./mc.sh pvp-status`
		Toggles player combat on/off live and checks current PvP state.

Economy	`./mc.sh money-add <P> <$>`
	`./mc.sh money-set <P> <$>`
	`./mc.sh shop-status`
		Deposits money into player wallet, overrides exact balance, or inspects 2,087-item shop categories.

Mail Daemon	`./mc.sh mail-status`
	`./mc.sh mail-start`
	`./mc.sh mail-test`
		Checks in-game mail queue, starts background email alert daemon, or sends test verification email.

Backups	`./mc.sh backup`
	`./mc.sh backups`
	`./mc.sh restore <file>`
		Creates live zero-downtime backup (keeps last 2), lists remote archives, or restores server completely.

3. Automated Zero-Downtime Backups & Total Disaster Recovery

The server utilizes a non-blocking, atomic backup architecture that guarantees zero data loss, zero world corruption, and zero player disconnects during archiving.

Zero-Downtime Online Backup Protocol:

1. **Flush Cache:** Executes save-off followed by save-all flush in console to force all world chunks, player inventories, and chest data from RAM to disk.
2. **HUD Notice:** Displays an actionbar notification to all players: '⬛ *Saving World Backup...*'.
3. **Atomic Archiving:** Creates a compressed .tar.gz archive (approx 4.6 GB) containing all worlds, claims, economy, mods, and configurations.
4. **Resume Auto-Save:** Executes save-on and notifies players: '⬛ *World Backup Completed!*'.
5. **Automated Retention:** Scans /home/ubuntu/minecraft-server/backups/ and strictly retains the **2 newest backups**, deleting older archives automatically.

Automated 3:00 AM Daily Maintenance:

A persistent systemd timer minecraft-log-maintenance.timer executes every single night at **03:00:00 AM IST**. It triggers manage_logs.py which runs the zero-downtime backup, prunes old archives, compresses logs older than 24 hours into .log.gz, and deletes archived logs older than 30 days. Logs are written to /home/ubuntu/minecraft-server/logs/cron.log.

1-Click Local PC Backup & Total VM Rebuild Tools:

Tool / Script	Location	Usage & Recovery Workflow
Download Backup	`download_backup.bat` `sync_backup.py`	Double-click on PC to pull the latest 4.6 GB server backup into D:\minecraft-server\backups\ via SCP. Auto-deletes older PC backups to keep strictly 2 local backups.
Disaster Recovery	`restore_backup.bat` `disaster_recovery.py`	If the Oracle Cloud instance is ever deleted, recreated, or corrupted, double-clicking this script uploads the latest local PC backup and reconstructs the full server in 1 step.

4. LuckPerms Security & Permission Matrix

Permissions are stored in an embedded H2 database (mods/luckperms/luckperms-h2-v2.mv.db). The hierarchy uses weight-based inheritance:

Group	Weight / Prefix	Inherits	Permissions Granted
default / member	`Weight: 0` `Prefix: None`	—	essentialcommands.tpa, .tpaccept, .tpdeny, .tpa.cancel, .back, .back.on_death, .home.set, .home.tp, .home.delete, .home.list, .spawn, .warp.tp, .warp.list, .rtp, .rules, .afk, .msg, .whisper, .reply, flan.claim, flan.menu, economycraft.shop, .balance, .pay, chestlocker.lock
mod	`Weight: 50` `Prefix: &9[Mod]`	member	essentialcommands.*, minecraft.command.weather, .time, .gamerule, .teleport, .tp, .gamemode, .clear, .effect, .kill, .title, .tellraw, .playsound, .particle, .ban, .kick, .mute, flan.admin, ledger.inspect, custom weather presets
admin	`Weight: 80` `Prefix: &c;[Admin]`	mod	Full wildcard access: *

Group	Weight / Prefix	Inherits	Permissions Granted
owner	`Weight: 100 Prefix: &4[Owner]`	admin	Full wildcard access: * + OP Level 4 permissions.

5. EconomyCraft 2,087-Item Crafting Mathematics

The server economy strictly derives all 2,087 item prices from foundational raw material base costs. Sell prices across the entire market are strictly balanced at **20% of purchase price** to prevent inflation.

Base Material	Buy Price ($)	Sell Price ($ - 20%)	Crafting Derivation Rules
Cobblestone	`$20.00`	`$4.00`	Foundational building material baseline.
Iron Ingot	`$250.00`	`$50.00`	Standard industrial ore baseline.
Gold Ingot	`$350.00`	`$70.00`	Piglin trading & clockwork component baseline.
Diamond	`$5,000.00`	`$1,000.00`	Precious gemstone & high-tier tool material.
Netherite Ingot	`$65,000.00`	`$13,000.00`	Calculated as (4 x Scrap $12k) + (4 x Gold $350) + Upgrade $15k.
Monster Spawner	`$1,000,000.00`	`$200,000.00`	Ultra rare endgame automation item.
Dragon Egg	`$2,500,000.00`	`$500,000.00`	Unique server trophy collectible.

6. Performance Tuning & Chunky Pre-Generation

To maintain solid 20.0 TPS with fast Elytra flight and multi-player exploration on 2 OCPUs, the following systems are in place:

- **Chunky Pre-Generation:** Over 256,000 chunks (5,000 block radius) are pre-rendered into disk region files. Chunky is paused during gameplay (/chunky pause) to dedicate 100% CPU to players.
- **Tuned View Distances:** view-distance=8 and simulation-distance=6 in server.properties provide the optimal balance between visual range and tick performance.
- **FerriteCore & Lithium:** Fast chunk serialization, entity deduplication, and threaded physics reduce idle memory pressure by ~40%.
- **Elytra 3-Second Continuous Boost:** Long Rockets Datapack upgrades fireworks to Flight Duration 5 (~3.2s continuous propulsion) with an actionbar countdown (3s → 2s → 1s) active only while gliding. No annoying broadcasts or lockout delays.
- **Pet Protection & Mount Locking:** Pet Protect Datapack immunizes all tamed animals from damage (Resistance 255) and prevents unauthorized riding with automatic dismount and in-game trust commands (/pet trust <player>, /pet lock).

7. Global Ledger Forensics, 30-Day Retention & Automated Maintenance

Ledger operates as the server's high-performance audit engine, recording all block breaks, placements, container transactions, entity deaths, and dimension changes in an asynchronous SQLite database. The system is tuned for permanent zero-leak operation with a rolling 30-day retention window.

Subsystem Component	Engine Specification	Operational Impact
Storage Engine	`SQLite WAL Mode (world/ledger.sqlite)`	Write-Ahead Logging allows non-blocking concurrent writes with high-speed query reads.
Retention Window	`30 Days Rolling (autoPurgeDays = 30)`	Automatically removes logs older than 30 days during server startup and scheduled nightly maintenance.
RAM & Queue Tuning	`batchSize = 2500 • batchDelay = 5`	Flushes the action queue to disk every 0.25s, eliminating memory bloat during mass block events.
Rollback Scope	`maxRange = 1,000,000 • range:@global`	Permits unlimited world-wide rollbacks across all dimensions (overworld, the_nether, the_end).
Nightly Auto-Maintenance	`3:00 AM Systemd Timer (manage_logs.py)`	Executes automated zero-downtime backup, log purge, SQLite WAL truncation, and query optimization.

Master Ledger & CoreProtect Command Reference:

Command / Alias	Permission & Role	Usage & Syntax Example
`/inspect` `/co i • /lg i`	Mod + Owner	Toggles inspection mode on/off. Click blocks or containers to read full history.
`/rollback` `/co rb • /lg rb`	Mod + Owner	/rollback range:50 after:2h /rollback source:<player> range:@global after:1d
`/undo` `/co restore • /ledger restore`	Mod + Owner	Reverts an accidental rollback immediately without data loss.
`/co preview` `/lg pv`	Mod + Owner	/co preview range:30 after:1h Shows client ghost blocks before committing.
`/ledger purge`	Owner Only (OP 4)	/ledger purge before:30d Manually clears old logs from the database.
`./mc.sh ledger-status`	Server Terminal	Shell dashboard displaying DB size, total logged actions, and queue backlog.
`./mc.sh ledger-purge`	Server Terminal	Shell script executing 30-day purge and PRAGMA wal_checkpoint(TRUNCATE).

AUDIT & DATABASE GOVERNANCE POLICY

Staff Delegation & Security Protocols:

• **Moderators ([Mod]):** Have full access to /inspect, /rollback, /undo, /co preview, /co search, /co page, and /co status to resolve player disputes and griefing autonomously.

• **Owner ([Owner]):** Holds exclusive authority over /ledger purge and direct disk database maintenance. Database files are preserved across server restarts and automatically included in ./mc.sh backup archives.

6. Anti-Cheat Engine, Disconnect Screens & Community Links

The Brown SMP features a production-grade Anti-Cheat watchdog with multi-second burst filtering and a strict 6-warning enforcement ladder, custom-branded disconnect screens, and official player channels:

System / Feature	Configuration & Policy	Operational Directive
Staff & Owner Exemption	`LuckPerms anticheat.bypass • tag ac_bypass`	Owner (asingh1905), OPs, and [Mod] staff completely bypass all anti-cheat checks.
Lag & Wi-Fi Protection	`1.5s Burst Window • 15s Window`	Network spikes and ping drops are grouped into single events. Requires 3 distinct events across 15s.
6-Warning Ladder	`Warn 1-2 (Chat) • Warn 3 (Kick)` `Warn 4-5 (Final) • Warn 6 (Perma-Ban)`	Permanent ban directs players to appeal on Discord (https://discord.gg/yeHYbuwJ7P) or Email (minecraft.the.brown@gmail.com).
Custom Whitelist Screen	`server_translations_api • en_us.json`	Displays private realm notice, Discord link, and owner email with instant automated email alert.
In-Game Community Commands	`/discord, /dc, /contact, /links`	Clickable chat links directing players to the official Discord invite and support email.

OFFICIAL COMMUNITY & SYSTEM GOVERNANCE

Official Discord Server: https://discord.gg/yeHYbuwJ7P
Official Support & Appeals Email: minecraft.the.brown@gmail.com
Watchdog Shell Commands: ./mc.sh anticheat-status, ./mc.sh anticheat-reset <player>, ./mc.sh anticheat-bypass <player>

7. Multi-Layer Cyber & DDoS Defense Architecture

To protect The Brown SMP from internet port scanners, SYN floods, Slowloris socket exhaustion, and packet crash exploits without introducing any latency or disrupting legitimate players, the server implements a hardened 4-layer defense perimeter:

Security Layer	Technology & Implementation	Protection & Zero-Latency Guarantee

Layer 1: Kernel Hardening	`/etc/sysctl.d/99-minecraft-network.conf`
	`net.ipv4.tcp_syncookies = 1`
	`somaxconn / syn_backlog = 8192`
		Kernel drops spoofed SYN floods automatically using cryptographic syncookies. Eliminates backlog exhaustion.

Layer 2: Stateful iptables Shield	`iptables MC_SHIELD (Port 25565)`
	`RELATED,ESTABLISHED Fast-Path`
	`connlimit > 6 • rate limit 10/5s`
		Active player packets hit rule #2 directly with **0 added latency**. Drops scanner bots, Slowloris multi-connections, and port sweeps.

Layer 3: Fail2Ban Automated Jails	`minecraft-scanner (1 strike = 7 days)`
	`minecraft-flood (6 disconnects = 24 hrs)`
	`sshd (Key Auth Brute-Force)`
		Automatically monitors logs for automated scanner probes (censys, shodan, FishNet) and connection spam, auto-banning offending IPs at kernel level.

Layer 4: Application Security Mods	`CrashExploitFixer 2.0.0`
	`Krypton 0.3.2`
	`ServerMessages 1.1.1`
		Patches entity selector recursion, SNBT hang exploits, overhauls Netty pipeline with Paper/Velocity async engine, and delivers mobile-optimized disconnect screens.

ZERO-LATENCY GENUINE PLAYER ASSURANCE

Zero-Impact Legit Player Guarantee: Genuine players only establish 1-2 connections during login, which immediately transition to ESTABLISHED state. Legitimate players never trigger rate limits or connection limits.
Live Firewall Monitoring: Execute ./mc.sh security-status to inspect real-time dropped packet counters, banned bot IPs, and loaded security mods.

8. WhatsApp Automation Control Centre & Desired State Architecture

The Brown SMP implements an authoritative Automation Control Centre supervising 15 core units across systemd services, systemd timers, and background bot workers. To prevent autonomous watchdog conflicts when administrators intentionally stop or pause a service, all units operate under an **Explicit Desired State Model**:

Automation Unit	Type & Schedule	Desired State & Watchdog Isolation Policy
`whatsapp-bot` `whatsapp-bot.service`	Systemd Service Continuous	**CRITICAL:** Node.js Baileys bot, Express Cloud REST API, clipboard & transfer manager. Restart reloads in ~3s. Stop blocked unless forced.
`minecraft-watchdog` `minecraft-watchdog.service`	Systemd Service Continuous (15s loop)	**HIGH:** Liveness monitor for port 25565. When stopped via /automation stop, writes data/.server_stopped_manually to suppress self-healing restarts.
`server-sentinel` `server-sentinel.service`	Systemd Service Continuous	**MEDIUM:** Host resource sentinel monitoring CPU, RAM, NVMe threshold alerts.
`minecraft-chunky-manager` `minecraft-chunky-manager.service`	Systemd Service Dynamic Pausing	**LOW:** World pregeneration coordinator. Auto-pauses during player sessions and 03:00 backups. Can be paused via /automation pause chunky.
`daily-server-report` `daily-server-report.timer`	Systemd Timer Daily 08:00 IST	**MEDIUM:** Triggers daily server intelligence report and delivers to WhatsApp & email.
`minecraft-log-maintenance` `minecraft-log-maintenance.timer`	Systemd Timer Daily 03:00 IST	**HIGH:** Nightly world flush, tar.zst world backup, and log rotation.
`bot-cloud-cleanup`	Bot Worker Every 30 seconds	**MEDIUM:** Scans SQLite database and purges expired clipboards, downloads, and temp files.

AUTOMATION CONTROL SYNTAX & GOVERNANCE

Automation Commands:

- /automation - Interactive dashboard with live unit states and conflict warnings.
- /automation list [all|running|scheduled|paused|failed] - Filtered inventory.
- /automation inspect <id> • /automation status <id> • /automation logs <id> [lines]
- /automation pause <id> • /automation resume <id> • /automation stop <id> • /automation start <id> • /automation restart <id>

9. Granular Command ID & Category Permission Engine (1,384 Commands)

The Brown SMP implements a zero-bypass, dual-layer Role-Based Access Control (RBAC) and permission engine governing all **1,384 canonical commands** across **50 operational categories**. The Primary Owner (+918822786312) can delegate access either at the atomic command ID level or at the comprehensive category level with automatic time-based expiry (TTL), conflict resolution, and an immutable cryptographic audit trail.

Command Syntax	Access & Role	Operational Directive & Enforcement
`/category grant <CAT> <phone> [duration] [reason]`	Primary Owner Only	Delegates an entire category of commands (e.g. MEDIA_PDF, PRINT_WORKBENCH, SYS_MONITORING) with automatic TTL expiry (1h, 24h, 7d, or perm).
`/category revoke <CAT> <phone>`	Primary Owner Only	Immediately revokes a delegated category grant, invalidating all associated commands for the user.
`/category list • /category info <CAT>`	Moderator + Owner	Inspects the 50 indexed categories, command counts, default roles, and active delegation status.
`/category-perm preview <CAT> <phone>`	Primary Owner Only	Performs a dry-run check displaying exactly which commands will be granted before committing.
`/category audit [limit]`	Primary Owner Only	Audits recent GRANT, REVOKE, EXPIRE, and ROLLBACK events from the SQLite audit ledger.
`/command add <id> <phone> [duration] [reason]`	Primary Owner Only	Grants single atomic command permission (e.g. /command add MC.STATUS +919876543210 1h).
`/command remove <id> <phone>`	Primary Owner Only	Revokes a specific delegated atomic command permission immediately from the user.
`/command rollback <phone> • /category rollback <phone>`	Primary Owner Only	Emergency security kill-switch: wipes all delegated atomic and category permissions for a phone number instantly.

ZERO-LEAK PRIVILEGE ISOLATION ASSURANCE

Rigorous Single-Permission & Category Isolation Guarantee:
• **Hierarchy:** Primary Owner (+918822786312) > Secondary Owner > Moderator > Member > Delegated User.
• **Least Privilege:** When a user is granted MEDIA_PDF, they receive immediate access to all PDF operations, but any attempt to run /sh, /mc stop, /sys kill, or undelegated tools is blocked with ■ Permission Denied: Access Restricted.
• **Cryptographic Non-Delegable Primitives:** Raw shell execution (/sh, /term), service stop/restart, and security rollback remain hardcoded to the Primary Owner phone number and cannot be delegated under any circumstances.

10. Human-Friendly Short URL Ecosystem

The Brown SMP replaces ugly, unreadable database hashes and random UUIDs with clean, professional, human-readable short URLs across all web services, clipboards, transfers, and file shares:

Short Route Pattern	Service & Destination	Slug Architecture & Security Controls
`https://.../s/<slug>`	Server Status, Rules & Shares	Direct links to public server status, live rules handbook, and shared system dashboards (e.g. /s/server-rules).
`https://.../c/<slug>`	Online Clipboard Workspaces	Meaningful multi-block text clipboard links (e.g. /c/college-physics-notes). Backward compatible with /clip/:token.
`https://.../t/<slug>`	Temporary File Transfers	Drag-and-drop temporary transfer bundles (e.g. /t/event-schematics-pack). Backward compatible with /transfer/:token.
`https://.../f/<slug>`	Personal Cloud Files	Expiring download links for personal cloud files. Backward compatible with /d/:token.
`https://.../p/<slug>`	Print & Layout Jobs	Download ready-to-print PDFs, imposed booklets, tiled posters, and proof previews generated by the workbench.
`https://.../u/<slug>`	Custom Vanity Short URLs	General URL shortener with click analytics, expiry countdowns, and collision resolution (/url shorten <url> [slug]).

HUMAN-FRIENDLY URL PROTOCOLS

Slug Collision & Length Optimization Engine:
- **Auto-Slugify:** Automatically generates clean alphanumeric kebab-case slugs up to 60 characters.
- **Collision Resolution:** Existing slugs receive deterministic suffixes (-2, -3).
- **36 Reserved Keywords:** System routes (api, admin, login, clip, transfer, status, metrics, etc.) are protected.
- **Efficiency Metrics:** Computes exact character and byte savings; warns if custom slug is longer than original URL.

11. Advanced PDF, Print & Imposition Workbench

Integrated directly with native Poppler utilities (pdftoppm), pdf-lib, and CUPS hardware printing, The Brown SMP features a production-grade print and imposition engine with an interactive 15-option WhatsApp wizard:

Workbench Feature	WhatsApp Command Syntax	Imposition Mechanics & Capabilities
Interactive Wizard	`/print wizard` `/print menu`	Step-by-step state machine with 15 options: paper size, scale, orientation, N-up grid, booklet signatures, poster tiling, margins, and print presets.
Scale & Fit Modes	`/print fit <file> [mode] [paper]` `/pdf scale <factor>`	Four precision scaling modes: FIT_PAGE (scale up/down to margins), SHRINK (only scale if oversized), ACTUAL (100% original dimensions), and CUSTOM.
N-Up Grid Layout	`/print nup <pages> [layout] [border]` `/pdf nup 2|4|6|8|9|16`	Arranges multiple pages per physical sheet with automatic cell dimension math, configurable reading orders (LTR, RTL, TTB, ZIGZAG), and optional crop/border lines.
Booklet Imposition	`/print booklet <file> [sig]` `/pdf booklet`	Saddle-stitch imposition reordering pages into 4-page folded signatures (e.g. pages 4,1 on front; 2,3 on back). Renders subtle fold crease guide lines.
Poster Tiling	`/print poster <file> [grid] [overlap]` `/pdf poster 2x2|3x3`	Splits large single pages across multi-sheet grids (2x2, 3x3) with configurable glue overlap margins (default 15mm) and alignment cut marks.
Bates Numbering	`/pdf bates <file> [prefix] [digits]`	Stamps sequential legal / archive tracking numbers (e.g. SMP-000001) at bottom-right of every page with configurable font size and margin.
Passport Photo Sheet	`/print passport <image>`	Formats 6 standard passport photos (35x45mm) onto a 4x6 inch (102x152mm) photo paper sheet at 300 DPI with light border cutting guides.
Hardware Printing	`/print send <file> [printer]` `/print printers • /print status`	Queries CUPS / lpstat daemon truthfully. If physical printers are connected, sends native print job; otherwise provides print-ready PDF output.

PAPER CATALOGUE & WORKBENCH PRESETS

Supported Paper Size Standards:
- **International ISO:** A3 (842x1191pt), A4 (595x842pt), A5 (420x595pt), A6 (298x420pt).
- **North American ANSI:** Letter (612x792pt), Legal (612x1008pt), Tabloid (792x1224pt).
- **Photo Standards:** Photo 4x6 inches (288x432pt), Custom Dimensions (arbitrary width/height pt).
- **Presets:** draft (2-up fast), handout (4-up bordered), pocket-booklet (A5 saddle-stitch), poster-4x (2x2 A4), passport-sheet (6-up 4x6").

12. Universal Media, Document & Digital Utility Workbench

Integrated directly with WhatsApp and Oracle Cloud Linux ARM64 native tooling (libvips, poppler-utils, qpdf, ImageMagick), the bot processes media attachments and commands on the fly:

Laboratory	Supported Commands	Processing Engine & Deliverables

Image Optimization	`/img resize <dims>` • `/img compress <q>`
	`/img convert <webp|png|jpg|avif>`
	`/img rotate / flip / crop / watermark`
		High-speed sharp/libvips processing with EXIF orientation correction, WebP conversion, and lossless quality optimization.

PDF Toolkit	`/pdf compress <low|balanced|high>`
	`/pdf split <range>` • `/pdf merge`
	`/pdf rotate / watermark / pageno / text`
		pdf-lib, qpdf, and pdftoppm pipeline for document compression, multi-PDF merging, page extraction, watermarking, encryption, and repair.

QR & Barcodes	`/qr <text|url|wifi|contact|upi>` `/barcode <type> <value>`	Generates vector/PNG QR codes and standard barcodes (Code128, EAN-13, UPC-A, ITF-14) with custom styling.
Dictionary & Lexicon	`/sw <word>` • `/dict <word>` `/search word <word>`	Multi-source linguistic intelligence: phonetics, definitions, parts of speech, synonyms, antonyms, and etymology.