Commute Tracker User Guide

Welcome to **Commute Tracker**! This guide will help you get the most out of your commute tracking experience and understand all the powerful features at your fingertips.
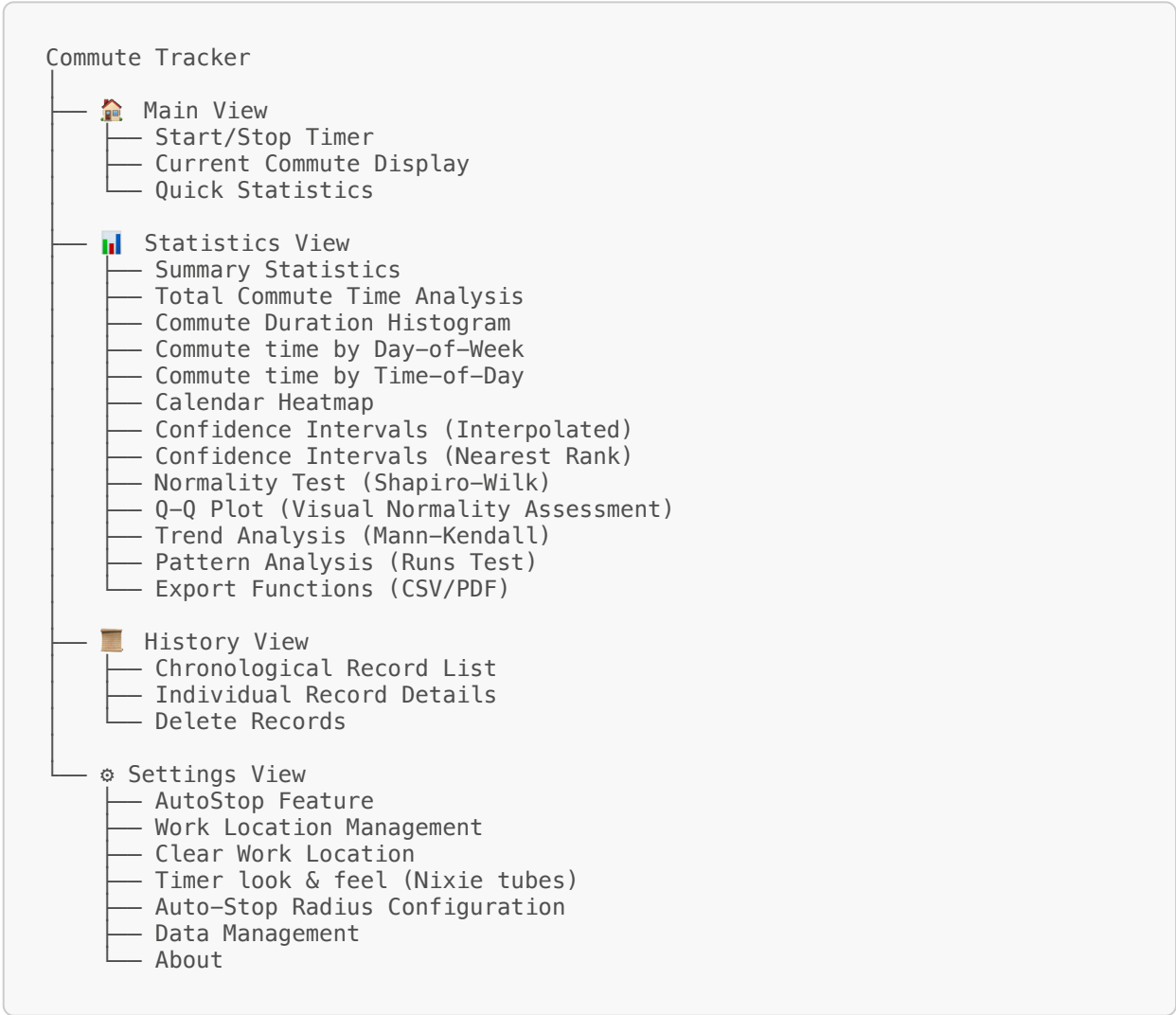
What is Commute Tracker?

Commute Tracker is a smart, privacy-focused application that helps you:

- **Track** your daily commute times with GPS precision
- **Analyze** patterns and trends in your travel data
- **Optimize** your departure times based on real statistics
- **Learn** fascinating insights about your daily routine

Best of all, it's a **Progressive Web App (PWA)**, which means it works offline, installs like a native app, but requires no app store and respects your privacy by keeping all data on your device.

Application Overview

```
Commute Tracker

    ── 🏠 Main View
         ── Start/Stop Timer
         ── Current Commute Display
         ── Quick Statistics

    ── 📊 Statistics View
         ── Summary Statistics
         ── Total Commute Time Analysis
         ── Commute Duration Histogram
         ── Commute time by Day-of-Week
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         ── Calendar Heatmap
         ── Confidence Intervals (Interpolated)
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         ── Normality Test (Shapiro-Wilk)
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         ── Trend Analysis (Mann-Kendall)
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```

Getting Started

Installing the App

Commute Tracker is a Progressive Web App (PWA) - a modern web technology that combines the best of websites and native apps:

What's a PWA?

Think of a PWA as a website that behaves like a phone app:

- ✅ **Works offline** - Once loaded, you can use it without internet
- ✅ **Installs to your device** - Appears on your home screen like any app
- ✅ **No app store needed** - Install directly from your browser
- ✅ **Always up-to-date** - Updates automatically when online
- ✅ **Privacy-first** - All your data stays on YOUR device, never sent to servers
- ✅ **Cross-platform** - Works on iPhone, Android, tablets, and computers

Installation Steps

URL: https://johan162.github.io/commute

On iPhone/iPad (Safari):

1. Open the app URL in Safari
2. Tap the **Share** button (box with arrow, top-right corner)
3. Scroll down and tap **"Add to Home Screen"**
4. Tap **"Add"**
5. The app icon appears on your home screen!

On Android (Chrome):

1. Open the app URL in Chrome
2. Click the extended menu (three vertical dots)
3. Select **"Add to home screen"**
4. In the popup shown choose **"Install as App"**
5. The app icon appears in your app drawer!

On Desktop (Chrome/Edge):

1. Open the app URL
2. Clicke the extended menu (three vertical dots)
3. Select **"Cast, save and share"**
4. Click **"Install page as app…"**

- Click "Install page as app..."

First-Time Setup

1. **Grant Location Permission**: The app needs GPS access to track your commute
2. **Record Your Work Location** (optional): For automatic arrival detection. **Note:** There are options to enable automatic recording of position when timer is stopped.
3. **Take Your First Commute**: Hit "Start Commute" and let the tracking begin!

Main View - Your Command Center

The Main View is your starting point for every commute.

Starting a Commute

1. **Press "Leaving"** when you leave home
2. The timer starts immediately
3. A large, easy-to-read display shows your elapsed time
4. Your GPS location is recorded

Stopping a Commute

Manual Stop:

- Press **"Arrive"** when you arrive at work
- The time is saved automatically

Automatic Stop (with AutoStop enabled):

- The timer stops automatically when you enter your work location radius
- No button press needed - just arrive and it's recorded!
- Perfect for hands-free operation

What You See

- **Large Timer Display**: Shows hours, minutes, and seconds
- **Current Status**: "Commute started.." or "Press 'Leaving' to start"
- **Quick Stats**: Your average commute time is always visible
- **Record Count**: See how many commutes you've tracked

> [!TIP] 💡 **Pro Tip**: The app works in the background! You can switch to other apps, lock your phone, or even close the browser - the timer keeps running.

Statistics View - Discover Your Patterns

This is where the magic happens! The Statistics View transforms your raw commute data into actionable insights.

Summary Statistics

Your basic numbers at a glance:

- **Total Trips**: How many commutes you've recorded
- **Min Time**: Your fastest commute ever (aim to beat it!)
- **Max Time**: Your slowest commute (avoid whatever caused this!)
- **Average**: Your typical commute time
- **Median**: The "middle" time when your commutes are sorted

What's the difference between Average and Median?

- **Average** adds all times and divides by the count. A few very slow commutes can pull this up.
- **Median** is the middle value. It's more resistant to outliers (those days with terrible traffic).

If your median is much lower than your average, you have some unusually slow commutes pulling up the average!

90% Confidence Intervals

Two cards show you where 90% of your commutes fall:

Interpolated Interval:

- Uses mathematical calculation
- Shows the precise range where 90% of commutes land
- May show times you've never actually experienced

Nearest Rank Interval:

- Uses your actual recorded times
- Shows the closest real commutes to the 90% boundaries
- More "tangible" - these are times that actually happened

Practical Use:

- **Planning**: If your 90% CI upper bound is 35 minutes, leave at least 35 minutes before you need to arrive
- **Realistic Expectations**: You'll arrive within this range 9 out of 10 times
- **Buffer Time**: The difference between low and high tells you how unpredictable your commute is

Normality Test (Shapiro-Wilk)

Requires 20+ commutes

What is it? A statistical test that checks if your commute times follow a "normal distribution" (the famous bell curve).

The Bell Curve: Imagine most commutes cluster around your average (say, 25 minutes), with fewer commutes being very fast (20 min) or very slow (30 min). This creates a bell-shaped pattern.

What You See:

- **W Statistic** (0 to 1): Closer to 1 means more "normal"
- **p-value**: The probability your data matches a bell curve
- **Result**: ✓ Normal or ⚠ Not Normal

Why Does This Matter?

If NORMAL (p > 0.05):

- Your commute is predictable and consistent
- Most days are similar to your average
- Standard planning methods work well
- Statistical predictions are reliable

If NOT NORMAL (p ≤ 0.05):

- Your commute has distinct patterns or clusters
- Maybe Mondays are always slower, or weather impacts you significantly
- You might have multiple "typical" commute times
- Look for patterns in your history to understand why

Real-World Example: Sarah's commute shows "Not Normal" because she has two distinct patterns:

- Fast commutes (20-22 min) when she leaves before 7 AM
- Slow commutes (35-40 min) when she leaves after 7:15 AM Her solution? Always leave before 7 AM!

Q-Q Plot (Quantile-Quantile Plot)

Requires 10+ commutes

What is it? A Q-Q (Quantile-Quantile) plot is a visual way to check if your commute times follow a normal distribution. It's like a "picture worth a thousand words" complement to the Shapiro-Wilk test above.

How to Read It:

The chart plots your actual commute times against what they *should* be if perfectly normally distributed:

- **X-axis (Theoretical Quantiles)**: Where your times would fall if perfectly normal
- **Y-axis (Sample Quantiles)**: Where your actual times fall
- **Red diagonal line**: The "perfect normal distribution" reference line
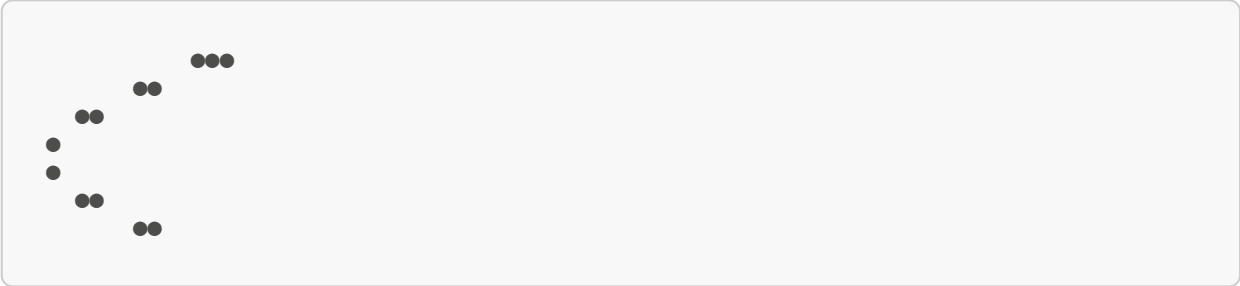- **Blue dots**: Your actual commute time data points

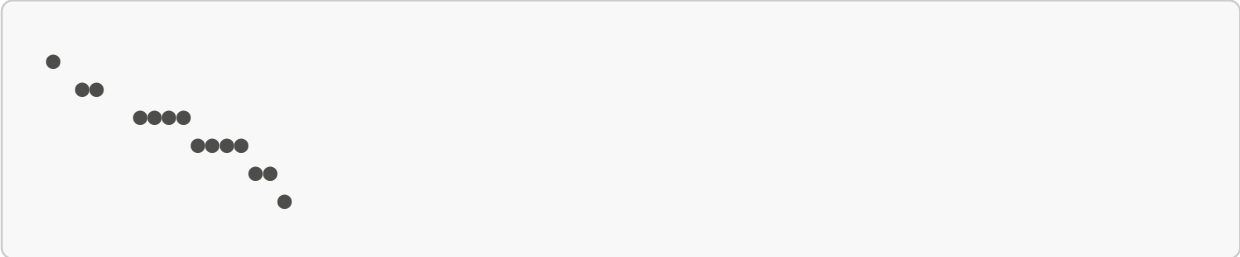**The Key Rule: Points Should Follow the Line**

Perfect Fit:
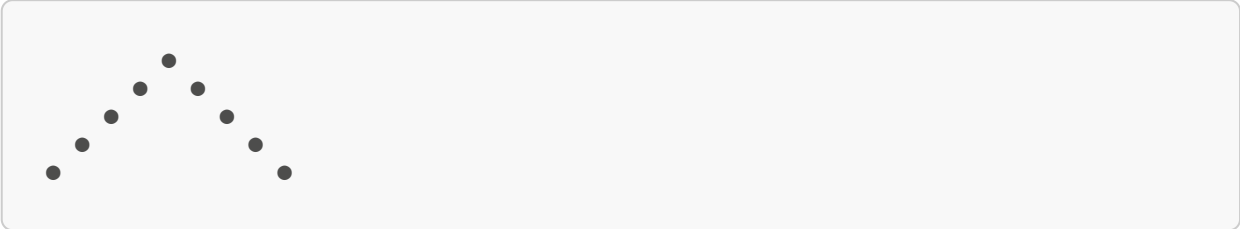
If your blue dots closely follow the red line, your data is normally distributed!
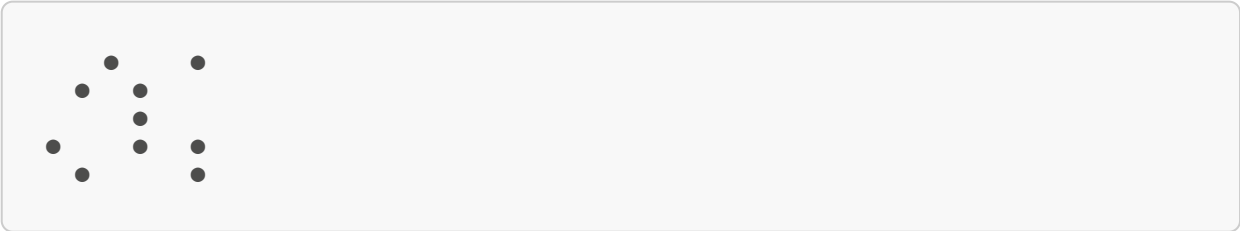
S-Shaped Curve:

Data has "heavier tails" – more extreme values (very fast or very slow commutes) than a normal distribution would predict.

Reverse S-Curve:

Data has "lighter tails" – fewer extreme values, more clustered around the middle.

Scattered Points:

Data may have outliers or multiple distinct groups (like Sarah's example with early vs. late departures).

R² (Goodness-of-Fit) Statistic

Below the Q-Q plot, you'll see an **R² value** - a number between 0 and 1 that quantifies how well your data fits a normal distribution.

What You See:

- **R² Value**: A number like 0.9876 (ranges from 0.0 to 1.0)
- **Rating**: Excellent / Very Good / Good / Moderate / Fair / Poor
- **Interpretation**: Plain English explanation

Understanding R² Values:

R² Range	Rating	What It Means
≥ 0.99	Excellent	Data fits normal distribution very closely
0.95-0.99	Very Good	Data fits normal distribution well
0.90-0.95	Good	Data reasonably fits normal distribution
0.80-0.90	Moderate	Data shows moderate fit to normal distribution
0.70-0.80	Fair	Data has fair fit to normal distribution
< 0.70	Poor	Data does not fit normal distribution well

What Does R² Actually Measure?

R² calculates the "distance" between your data points and the theoretical line, in other words it calculates the Mean-Square Error between the theorethical line and the data points.

- **R² = 1.0**: Perfect fit - all points exactly on the line
- **R² = 0.95**: 95% of variation explained by normal distribution
- **R² = 0.70**: Only 70% of variation explained - significant deviations

Why Two Tests for Normality?

You might wonder: "Why have both Shapiro-Wilk test AND Q-Q plot with R²?"

They complement each other:

Shapiro-Wilk (Statistical Test):

- ✅ Gives definitive yes/no answer
- ✅ Provides p-value for statistical rigor
- ❌ Doesn't show *how* data deviates
- ❌ Can be affected by sample size

Q-Q Plot + R² (Visual Assessment):

- ✅ Shows *where* and *how* data deviates
- ✅ Easy to understand visually
- ✅ R² quantifies the fit (0-1 scale)
- ✅ Helps identify patterns (S-curve, clusters, outliers)

Real-World Example: Johan's data shows:

- Shapiro-Wilk: p = 0.03 (Not Normal)
- Q-Q Plot: Points curve away at both ends (S-shape)
- R² = 0.82 (Moderate fit)

Looking at the S-curve, he realizes he has more extreme commutes than expected - both very fast (< 20 min, light traffic days) and very slow (> 45 min, accident days). The Q-Q plot helps him *see* this pattern that the Shapiro-Wilk test detected statistically.

Practical Tips:

1. **Look at the plot first** - Your eyes are excellent pattern detectors

2. **Check R²** - A single number to quantify the fit
3. **Read the interpretation** - Plain English explanation
4. **Compare with Shapiro-Wilk** - They should generally agree
5. **Don't worry if not perfect** - Few real-world datasets are perfectly normal!

When R² and Shapiro-Wilk Disagree:

Occasionally you might see:

- Shapiro-Wilk says "Normal" but R^2 is 0.85 (Moderate)
- Or vice versa

This is normal! Different tests use different methods:

- Shapiro-Wilk uses a strict p-value threshold (0.05)
- R^2 measures overall fit on a continuous scale
- Small sample sizes can cause differences

Rule of thumb: If both show reasonable agreement (both say "pretty normal" or both say "not very normal"), trust them. If they wildly disagree, you probably need more data.

Trend Analysis (Mann-Kendall Test)

Requires 10+ commutes

What is it? Detects if your commute times are getting systematically longer, shorter, or staying stable over time.

What You See:

- **Trend Direction**:

    - 📈 Getting Longer - Bad news!
    - 📉 Getting Shorter - Great news!
    - ➡️ Stable - Consistent and predictable

- **Confidence Level**:

    - 💪 Very Strong - Definitely happening ($p < 0.01$)
    - 👍 Moderate - Probably real ($p < 0.05$)
    - 🤔 Weak - Might be real ($p < 0.10$)
    - 🤷 Not Significant - Just random variation

Why Does This Matter?

Getting Longer 📈 :

- Traffic is worsening in your area
- Seasonal changes (winter weather, school schedules)
- Construction or road changes
- **Action**: Consider alternative routes or departure times

Getting Shorter 📉 :

- Your route is improving!
- You've learned the traffic patterns
- Infrastructure improvements
- **Action**: Keep doing what you're doing!

Stable ➡️ :

- Predictable commute - easy to plan around
- Consistent traffic patterns
- **Action**: Your current routine is working well

🌊 Pattern Analysis (Runs Test)

Requires 10+ commutes

What is it? Detects if your commute times are truly random or show patterns of clustering or oscillation.

What You See:

- **Pattern Type**:
    - 🎲 **Random** - Each commute is independent, no predictable pattern
    - 📦 **Clustered** - Similar times grouped together (several fast days, then several slow days)
    - 🌊 **Oscillating** - Alternating between fast and slow commutes

Why Does This Matter?

Random 🎲 :

- Daily traffic is unpredictable
- Each day is a fresh start
- Weather or random events dominate
- **Strategy**: Build in buffer time, accept variability

Clustered 📦 :

- You have multi-day patterns
- Might be weekly cycles (slow Mondays, fast Fridays)
- Weather patterns (rainy weeks vs. sunny weeks)
- **Strategy**: Look at your calendar - can you identify the clusters? Adjust plans for "slow periods"

Oscillating 🌊 :

- Every-other-day pattern
- Might relate to your schedule (early days vs. late days)
- Behavioral factors
- **Strategy**: Track what makes "fast days" fast and replicate it

Real-World Example: Johans's data shows clustering (📦).He realizes his commute is fast Monday-Wednesday (leaves at 6:45 AM for gym) but slow Thursday-Friday (leaves at 7:30 AM). Now he knows: leave before 7 AM for a fast commute, or expect 10 extra minutes if leaving later!

Commute Duration Histogram

A visual chart showing how your commute times are distributed.

How to Read It:

- **X-axis** (bottom): Commute time ranges (e.g., 20-25 minutes, 25-30 minutes)
- **Y-axis** (left side): Number of commutes in each range
- **Bars**: Taller bars = more commutes in that time range

What to Look For:

- **Single Peak**: One tall bar in the middle = consistent commute
- **Two Peaks**: Two tall bars = you have two "typical" commute times
- **Long Tail**: Bars stretching far right = occasional really slow commutes
- **Bin Size Slider**: Adjust to see more/less detail (1, 2, 5, or 10-minute groupings)

> [!TIP] 💡 **Insight**: If you see two distinct peaks, dig into your history to understand what causes each pattern!

Time of Day Breakdown

A circular chart showing when your commutes happen.

Features:

- See which hours you commute most often
- Identify your typical departure time
- Spot irregular patterns (maybe you should leave earlier?)

Total Commute Time Analysis

Calculate how much time you've spent commuting over different periods.

Available Views:

- **Per Day**: Select any date
- **Per Week**: Choose a week (Monday–Sunday)
- **Per Month**: Monthly totals
- **Per Year**: Annual summation

Why Track This?

- **Work-Life Balance**: See how much time commuting takes from your life
- **Justification**: Data to support working from home or relocating
- **Goal Setting**: Track if route changes save cumulative time

> [!NOTE] ** Fun Fact**: If you commute 30 minutes each way, 5 days a week, that's over 250 hours per year - more than 10 full days!

Export Your Data

Share, backup, or analyze your data elsewhere:

CSV Export:

- Opens in Excel, Google Sheets, or any spreadsheet app
- Contains all your raw data with timestamps
- Perfect for custom analysis

PDF Export:

- Beautiful summary report with charts
- Includes all statistics
- Great for sharing with coworkers or family
- Perfect for "Show and Tell" at work!

History View – Your Commute Timeline

Browse every commute you've ever recorded.

What You See

A chronological list (newest first) of all your commutes:

- **Date & Time**: When the commute started
- **Duration**: How long it took
- **Day of Week**: Helps spot weekly patterns
- **Visual Styling**: Color-coded by speed (fast = green, slow = red)

Managing Records

Delete Individual Records:

- Made a mistake? Left the timer running?
- Tap the **edit** icon in the top row
- Select the recods you want to delete (tickbox)
- Tap the red **"Delete"** button at bottom
- Confirm deletion
- Statistics automatically update

Data Integrity: Deleting records immediately updates all statistics and charts.

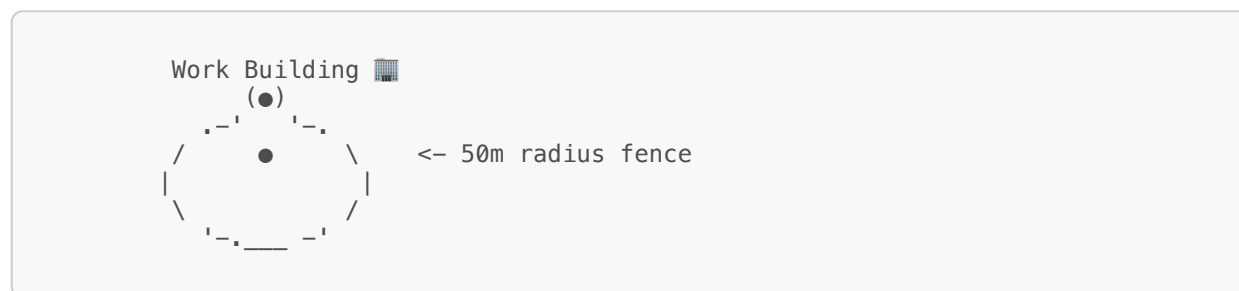## Settings View - Customize Your Experience

AutoStop Feature 🎯

What is it? Automatic arrival detection using GPS geofencing - the app stops the timer when you arrive at work, without you touching your phone!

How It Works:

1. **Virtual Fence**: You define a circular area around your work location
2. **GPS Monitoring**: The app continuously checks your location while the timer runs
3. **Automatic Trigger**: When you enter the fence radius, the timer stops automatically
4. **Save Time**: The commute is recorded without any action from you

The Technology: Geofencing

Geofencing creates an invisible circular boundary around a location:

```
        Work Building 🏢
            (●)
        .-'     '-.
       /     ●     \      <- 50m radius fence
      |             |
       \           /
        '-.___  _-'
```

When your phone's GPS detects you've crossed the boundary, it triggers an action (stopping the timer).

Why Use AutoStop?

- ✅ **Safety**: No need to touch your phone while parking or walking
- ✅ **Convenience**: Fully hands-free operation
- ✅ **Accuracy**: Stops at the exact moment of arrival
- ✅ **Consistency**: Never forget to stop the timer

Work Location Setup

Recording Your Work Location:

Method 1: Manual Recording

1. Go to Settings tab
2. Make sure you're physically at work
3. Tap **"Record Current Location"**
4. Your GPS coordinates are saved

Method 2: Auto-Record

1. Enable **"Auto-record Work Location"** toggle
2. Every time you stop the timer manually, your current location is recorded
3. Perfect for learning your work location over time

> [!WARNING] Remember to keep the auto-stop turned off while you are automatically or manuaklly recording your GPS locations as otherwise it will automatically turned off when you hit the GeoFence radius!

Multiple Recordings (Recommended):

- Record your work location multiple times (5–10 times is ideal)
- The app uses a Bayesian, accuracy-weighted average of all recordings
- More accurate readings (lower GPS error in meters) count more
- Accounts for GPS drift and different parking spots
- More recordings = higher confidence and better precision

Why Multiple Recordings? GPS isn't perfect — it can be off by 10–50 meters (sometimes more indoors). By recording multiple times from different spots (your parking space, the entrance, near windows), the app combines them using their reported accuracies. This Bayesian update makes the best possible use of the information you provide: precise measurements influence the result more than rough ones, giving you a truer center point.

How accuracy is used

- Every recording comes with an estimated GPS accuracy (e.g., ±8 m)
- The app gives more weight to precise points and less to noisy ones
- The combined result shows an "Effective accuracy," which improves as you add good measurements
- In Settings, you'll see:
    - "Bayesian Weighted Average Work Location" with coordinates
    - A color badge showing effective accuracy (green = excellent, red = poor)
    - An optional breakdown listing each recording and how much it contributed

Clearing Work Location:

Need to remove your saved work location? Use the **"Clear Work Location"** button:

When to Clear:

- 🏢 Changed jobs or work locations
- 🚗 Changed parking spots significantly (different building entrance)
- 📍 Recorded wrong location by mistake
- 🔄 Want to start fresh with new recordings

What Happens:

- All saved work location coordinates are deleted
- AutoStop will no longer work until you record a new location
- Your commute history is NOT affected (stays intact)
- You can immediately record a new work location

> [!NOTE] 🔒 **Safety Feature:** The button requires confirmation - you won't accidentally delete your location.

> [!TIP] **Pro Tip:** If AutoStop isn't working well, try clearing and re-recording your work location with 5-10 new recordings. GPS accuracy varies by weather, time of day, and device, so fresh recordings can improve performance.

Auto-Stop Radius Configuration

The Radius Slider (10m - 250m):

Choose how close you need to be before the timer automatically stops:

Small Radius (10-50m):

- ✅ Very precise - stops only when you're really there
- ✅ Avoids false triggers
- ❌ Might not trigger in parking garages or buildings with poor GPS
- **Best for**: Surface parking, outdoor work locations

Medium Radius (50-100m):

- ✅ Balanced approach
- ✅ Works reliably in most situations
- ✅ Stops when you're clearly "at work"
- **Best for**: Most users - start here!

Large Radius (100-250m):

- ✅ Always triggers, even with GPS inaccuracies
- ✅ Works in underground parking or thick buildings
- ❌ Might stop before you actually arrive
- **Best for**: Dense urban areas, GPS-challenged locations

🎯 **Recommendation**: Start with 75-100m, then adjust based on experience:

- Timer stopping too early? Reduce radius
- Timer not stopping? Increase radius

Data Management

Clear All Data:

- Permanently deletes all your commute records
- Erases work location recordings
- Resets the app to day-one state
- ⚠ **Cannot be undone!** - Use with caution

When to use:

- Starting fresh after a move or job change
- Selling/giving away your device
- Want to start a new tracking period

About

Information about the app, technologies used, license, and credits.

💡 Tips & Tricks

Getting the Most Accurate Data

1. **Consistent Start Point**: Try to start the timer at the same point each day (your driveway, parking lot exit, etc.)
2. **Let GPS Stabilize**: Wait 5-10 seconds after starting for GPS to lock in
3. **Keep Location On**: The app needs location services enabled for the entire commute
4. **Battery Considerations**: GPS tracking uses more battery - keep a charger handy for long commutes

Interpreting Your Statistics

"Normal" Day vs. Outlier:

- If one commute is way outside your confidence interval, something unusual happened
- Check the date - was there weather, an accident, or special event?

Tracking Experiments:

- Try a new route? Record for a week and compare statistics
- Test different departure times and see what works best

Seasonal Patterns:

- Expect your statistics to change with seasons (school schedules, weather, holidays)
- Consider "clearing data" and starting fresh each season for relevant insights

Privacy & Security

Your Data is YOURS:

- Everything stays on YOUR device
- No accounts, no cloud, no servers
- No one can see your data unless you share it (via export)
- Uninstalling the app deletes all data

Location Privacy:

- The app never sends your location anywhere
- GPS data is only used for timer functions
- Work location coordinates stay local

Learning More - The Fun of Data

Why Statistics are Cool (and Useful!)

You might think "statistics" sounds boring or complicated, but it's really just **finding stories in your numbers**. Each test reveals something interesting:

The Shapiro-Wilk Test asks: "Am I predictable?" **The Mann-Kendall Test** asks: "Am I getting better or worse?" **The Runs Test** asks: "Do I have hidden patterns?"

Experiments to Try

The Route Challenge:

1. Record 10 commutes on your usual route
2. Export the data
3. Try an alternative route for 10 commutes
4. Compare the statistics - which is faster? More consistent?

The Time Challenge:

1. Record commutes leaving at different times
2. Look for patterns in your histogram
3. Find your "sweet spot" departure time

The Weekly Pattern:

1. Record for a full month
2. Look at the Runs Test result
3. Check if certain days are consistently faster/slower
4. Adjust your schedule accordingly

Going Deeper

Want to learn more about the statistics?

- **Shapiro-Wilk Test**: Google "normal distribution examples" - see how it applies everywhere from heights to test scores
- **Mann-Kendall Test**: Search "trend analysis in time series" - used for climate data, stock prices, and more
- **Runs Test**: Look up "randomness testing" - used in cryptography and quality control

The same tools used in this app are used by scientists, engineers, and data analysts worldwide. You're now using professional-grade statistical methods!

Troubleshooting

Timer Won't Start

- Check location permission is granted
- Ensure the app is loaded (PWA's need to load once when online)
- Try refreshing the page

AutoStop Not Working

- Verify you've recorded your work location
- Check the AutoStop radius isn't too small
- Ensure location services stay enabled during commute
- GPS may be blocked in underground parking - use manual stop

Data Not Showing in Statistics

- Minimum records required: 5 for confidence intervals, 10 for trend/runs tests, 20 for normality test
- Check History tab to verify records exist

App Not Installing

- PWA installation requires HTTPS (secure connection)
- Try a different browser
- Check device storage isn't full

GPS Inaccuracy

- Cold start can take 30-60 seconds to acquire satellites
- Tall buildings and tunnels block GPS
- Wait in an open area for better accuracy

What's Next?

As you collect more data, the statistics become more powerful and insightful. Keep tracking, and you'll discover:

- Your optimal departure time
- Which days to avoid or plan buffer time
- Long-term trends in your commute
- The true cost of your commute in time

Most importantly, you'll have **data-driven insights** to make better decisions about your daily routine.

Happy commuting!

Questions? Suggestions? Found this guide helpful? Don't be shy to contact me or file a bug or feature suggestion on GitHub!

> [!NOTE] Current planned new features can be found in the TODO.md file!

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