# Microwave Oven Control Panel Physical & Interface Analysis

Existing panel study and proposed redesign

Tangible Design assignment

Submitted by -
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# 1: Introduction

Most Indian homes now have a microwave, but many people use only two buttons on it: Start and +30 seconds. The rest of the panel goes unused because it is hard to understand without the manual.

This project looks at the control panel of a typical Indian convection microwave in the Rs. 10,000–15,000 range. We studied how the panel is laid out, what the display says, and what a first-time user has to remember to cook something. We then redesigned the panel and its display so that a beginner can heat, defrost or bake food without help.

The redesign keeps the product a normal, affordable appliance. It does not add a touchscreen, an app or new cooking modes. It changes the layout, the labels, the order of steps and what the display shows.

# 2: Existing panels studied

We looked at panels from Samsung and LG because these two brands lead the Indian convection microwave market. Most of the information comes from each brand's own support pages and from retailer spec sheets. We did not take any panel apart.

| Model | Panel type | What stood out |
|---|---|---|
| Samsung MC28M6055C (India, 28 L) | Mode buttons + multi-function dial | Press Microwave, turn the dial for power, then press the dial. If you wait more than 5 seconds, it moves to the time step on its own. |
| Samsung ME19R7041 (US) | Membrane keypad | The clock is hidden. You hold Power Level for 3 seconds to reach it. |
| Samsung ME21M706B (US) | Membrane keypad | Clock is set through Options, then the number 9, then OK. |
| Samsung keypad models (US) | Number pad | Power is entered as codes from PL:10 to PL:100 and resets to full after every use. |
| LG MC2846SL (India, 28 L) | Touch keys | 251 auto-cook menus, 5 power levels, and features such as Diet Fry, Steam Clean and Fermentation. |
| LG MC2887BFUM (India, 28 L) | Buttons | 271 auto-cook menus, 175 of them Indian. |

The US models are not sold in India, but they use the same kind of panel logic. They show that the problems below are common across a brand's range, not one bad model.

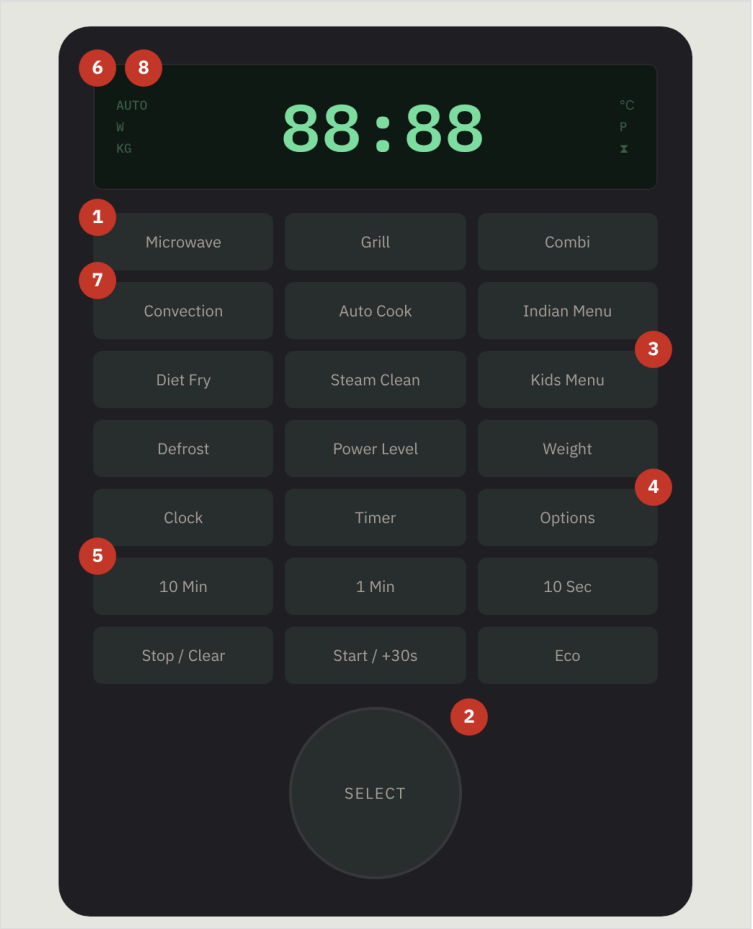



*Figure 1. A composite of a typical current panel, drawn from the models above. Red numbers mark the problems listed in Section 3. This is not an exact copy of any one product.*

# 3: What goes wrong for a beginner

The problem is not the number of features. The panel shows how the machine works inside, through codes, menu numbers and hidden button combinations. It does not show what the user is trying to do.

## 3.1: What earlier studies found

- In a quick user test, staff were asked to heat food for 1 minute 40 seconds on an office microwave. Almost nobody managed it. The causes were the button layout, the labels and vague feedback on the

display (Poole).

- Students interviewed at MIT said button functions change from model to model. Some keypads start on their own and others wait for Start, so many people only use the +30 s button (Lu, MIT).
- Other MIT interviewees used +30 s, the number pad, Start/Stop, power and defrost, and mostly ignored food presets. One family stuck velcro on keys because a visually impaired member could not tell them apart (MIT 2.744).
- A US patent describes typical panels as having every key visible and active at once, in small print, arranged differently on each model (US 9465407).
- An Indian thesis on cooking appliances found microwave panels especially hard to use because of the number of functions, and found users prefer Start/Stop in the middle of the panel (Krishikosh).

### 3.2: Issues on the current panel

| # | Issue | What we noticed | Suggested improvement |
|---|---|---|---|
| 1 | Too many equal keys | 15 to 25 keys of the same size. The three used daily (Start, +30 s, Stop) do not stand out. | Fewer keys, with the daily ones largest and in the middle. |
| 2 | No visible order | Nothing tells the user to pick a mode, then power, then time. The Samsung dial model jumps ahead after 5 seconds. | Show the steps on the panel and the display. Remove the timeout. |
| 3 | Codes instead of words | Power as PL:60. Auto-cook dishes picked by number from a list of 251 to 401 in the manual. | Plain words, and a short printed list of common dishes. |
| 4 | Hidden double jobs | Start also adds 30 s. The clock sits behind "hold Power Level 3 s" or "Options, 9". | One job per key, except where the double job is printed on the key. |
| 5 | Three ways to set time | 10 Min / 1 Min / 10 Sec presses, a dial, or a keypad, depending on the model. | One time control only. |
| 6 | Weak feedback | The display says "End" or "0". It does not say what to do next. | Clear done state, and a repeating tone until the door opens. |
| 7 | Mode jargon and container risk | Words like Combi, Convection and Diet Fry. No hint about which containers are safe, though steel tiffins are common. | Plainer mode names, and a container warning for each mode. |
| 8 | Power cuts | After a cut the display blinks 88:88 with no explanation. | Show that power was off and how to set the clock. |

The issue numbers match the red markers in Figure 1.

## 4: How the changes were decided

The assignment asked us to use an LLM council to suggest changes and check the work. An LLM council runs one question past five AI reviewers, each told to think in a different way. The reviewers then rate each other's answers without knowing who wrote them, and a final "chairman" pass sums up where they agree and disagree.

| Reviewer | What it looks for |
|---|---|
| Contrarian | What is wrong or will fail |
| First principles | What problem we are actually solving |

| Reviewer | What it looks for |
|---|---|
| Expansionist | Cheap ideas with a big payoff |
| Outsider | Words and steps that confuse someone with no background |
| Executor | Whether it can be built and how |

We used the council at two checkpoints:

1. **After the research.** The council checked the problem list and proposed changes. It moved container safety up the list, pointed out that power cuts are common in India and were missing, and settled five disagreements. For example, it kept Start and +30 s on one key because people already rely on it, and it ruled out a touchscreen as too costly for this price range.
2. **After the first design.** The council reviewed the working prototype. It found a safety bug: the child lock could stop the STOP key from working while food was cooking. It also found that the text line on the first display would need a more expensive screen. Both were fixed, along with several confusing labels.

The council's output was treated as advice, not as evidence. Its suggestions still need testing with real users (Section 7).

# 5: Proposed panel

The redesigned panel cuts 21 keys and a dial down to 8 main keys, 2 small keys and one dial. It is printed in four numbered zones, and the display lights the same four numbers, so the lit number is always the next thing to press. Pressing START with nothing chosen still gives 30 seconds on High, so a quick reheat stays one press.

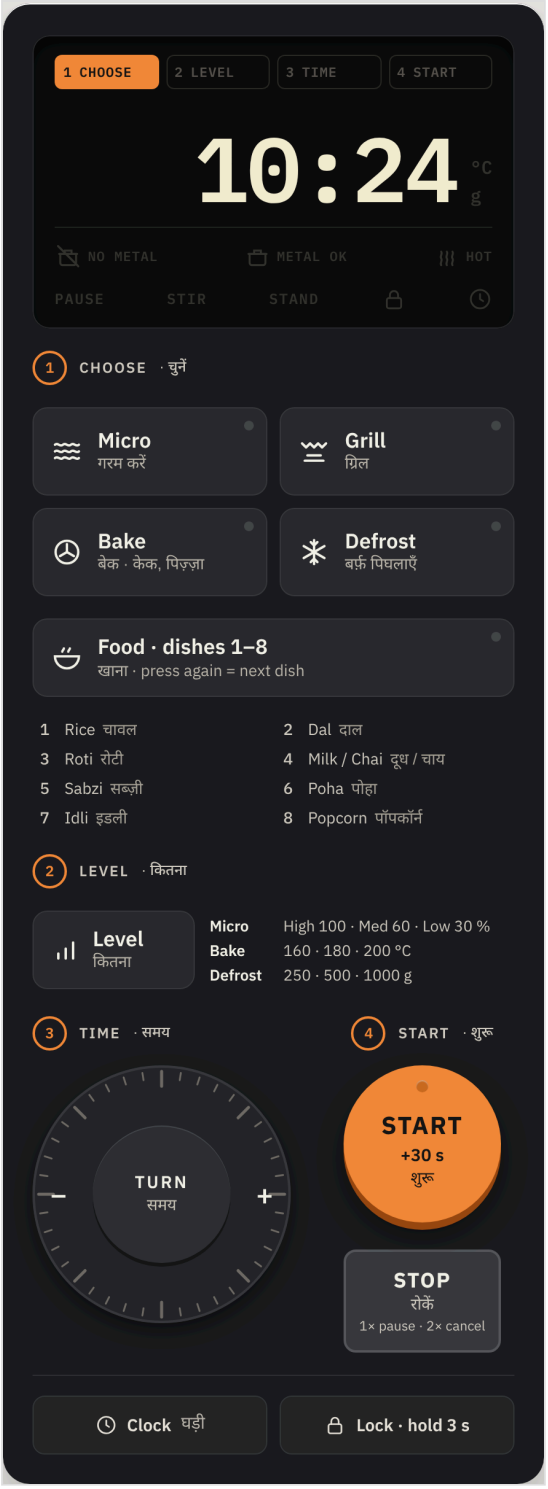



*Figure 2. The redesigned panel at rest. Step 1 is lit on the display to show where to begin.*

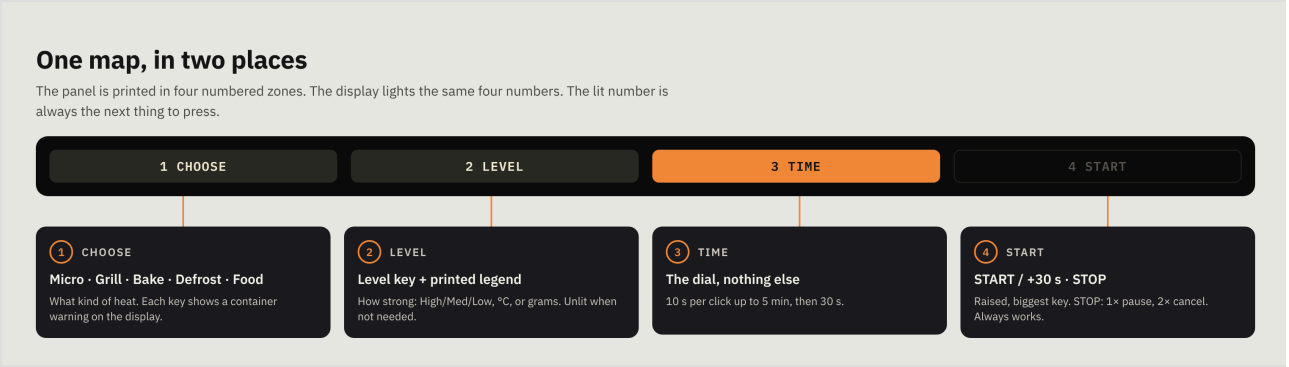



*Figure 3. One map in two places: the numbered zones on the panel and the numbered steps on the display.*

## 5.1: What changed and why

| # | Change | Fixes issue | How it helps a beginner |
|---|---|---|---|
| 1 | Numbered 4-step strip on the display, matching numbered zones on the panel | 2 | The next press is always shown. Users recognise it instead of remembering it. |
| 2 | No silent timeouts. Settings wait until START or STOP. | 2 | Users can stop and think without losing what they entered. |
| 3 | Power shown as HIGH, MED or LOW. Percentages printed on the key legend. | 3 | Words replace codes such as PL:60. |
| 4 | Eight common Indian dishes printed on the panel, picked with one Food key | 3 | A visible list replaces a 251-item list in the manual. |
| 5 | Defrost by printed weight: 250, 500 or 1000 g | 3 | Users pick a size and the machine sets the time. |
| 6 | The dial is the only time control. 10 Min / 1 Min / 10 Sec keys removed. | 5, 1 | One way to set time, and three fewer keys. |
| 7 | Two tiers of keys. START is the largest, raised, with a small bump to find it by touch. | 1, 4 | The keys used every day are found first. |
| 8 | STOP steps back during setup, pauses while cooking and cancels on a second press. Opening the door pauses. STOP works even with the child lock on. | 4, 6 | Mistakes can be undone. Nothing is cancelled without warning. |
| 9 | DONE on the display with STIR or STAND, and a tone every 30 s until the door opens | 6 | Hard to miss, and it says what to do next. |
| 10 | Container icon for each mode: NO METAL, or METAL OK with HOT | 7 | A warning at the moment the mode is chosen. |
| 11 | Convection renamed Bake. Labels in English and Hindi. | 7 | Readable by more people in a shared home. |
| 12 | After a power cut the display shows --:-- and a clock icon, and the clock resets to 12:00 | 8 | The display explains itself instead of blinking 88:88. |

## 5.2: Walk-through: heat food for 1:40 at medium power

On the Samsung MC28M6055C the user presses Microwave, turns the dial to the power level and presses the dial within 5 seconds. Then they turn the dial to set the time and press Start. If they pause too long, the panel moves on without them.

On the redesigned panel the user presses Micro, presses Level once to get MED, turns the dial to 1:40 and presses START. The number of presses is about the same. The difference is that each step is lit and labelled, and nothing moves on until the user does.

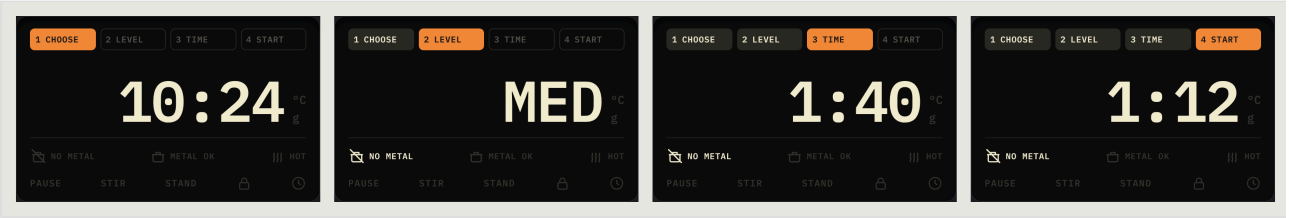



*Figure 4. The display during the walk-through, left to right: at rest, power set to MED, time set to 1:40, cooking.*

## 5.3: Other modes and states




*Figure 5. Left: Food dish 2 (Dal) chosen. The Level step stays unlit because it is not needed. Right: Bake at 180 °C, with METAL OK and HOT shown.*

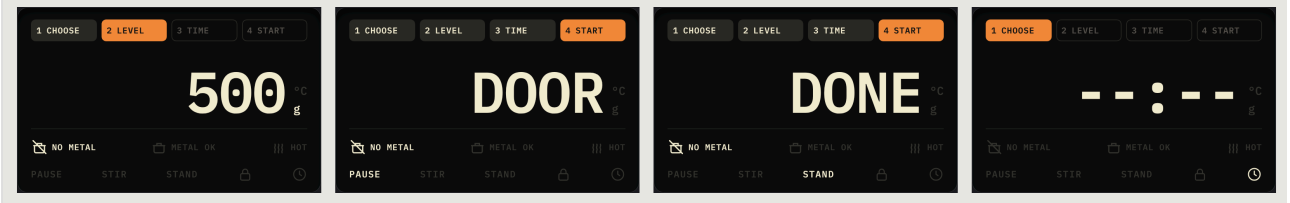



*Figure 6. Left to right: Defrost set to 500 g, door opened while cooking (paused), defrost finished (DONE and STAND), after a power cut.*

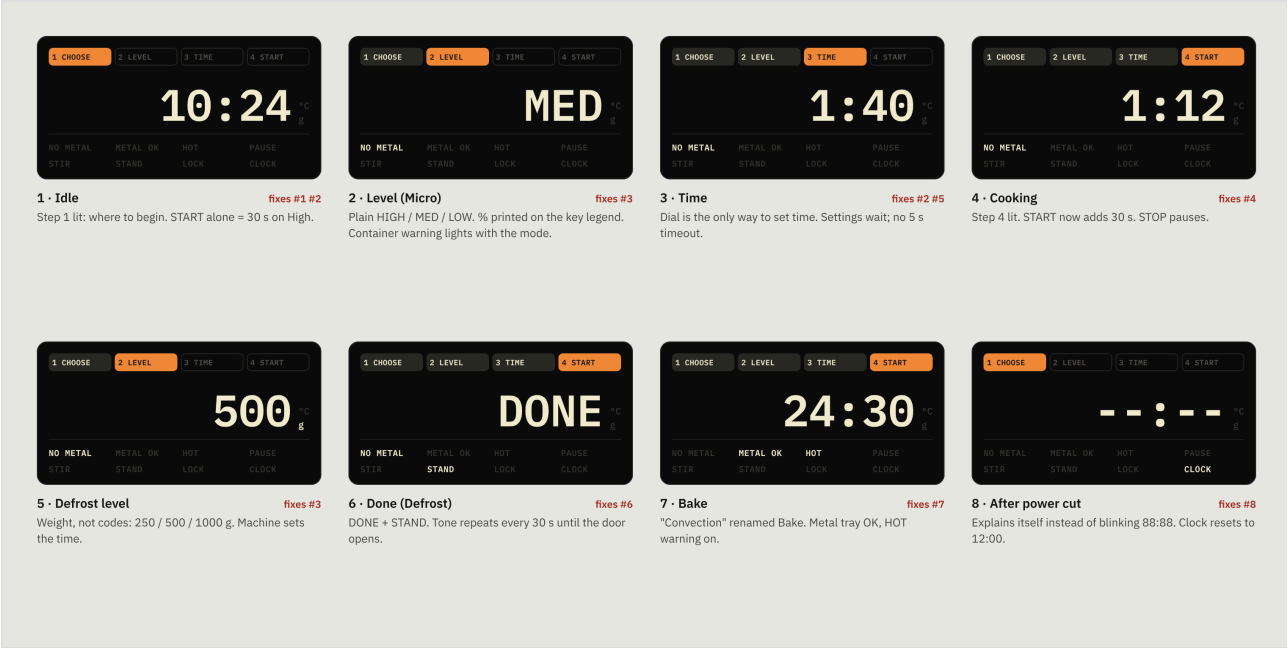



*Figure 7. Eight display states, each tagged with the issue it fixes.*

An interactive version of the panel was built in Claude Design so the flow can be tried and tested. It also counts presses and wrong presses for user testing.

# 6: Physical panel considerations

The redesign uses parts that already exist on panels in this price range: a sealed membrane keypad, a rotary dial and a segment LCD. Most changes are a new printed overlay and new firmware, not new hardware.

| Element | Existing | Proposed |
|---|---|---|
| Keys | About 21 keys plus a dial, all similar in size | 8 main keys, 2 small keys and a dial |
| START key | Same size and shape as other keys | Largest key, round, raised, with a small bump on top |
| STOP key | Same as other keys | Square, with a raised edge, so it feels different from START |
| Time control | Keypad, 10 Min / 1 Min / 10 Sec keys, or dial | Dial only, with felt clicks: 10 s per click up to 5 min, then 30 s |
| Display | 4-digit segment LCD with small mode icons | Backlit segment LCD: 4 large characters, a 4-step strip, container and HOT icons, and the words PAUSE, STIR and STAND |
| Labels | English, small print | English and Hindi, with an icon on every mode key |
| Sound | One beep | Three tones: key accepted, wrong key, food done |

The display only uses words and icons that can be printed into the LCD glass in advance. Hindi appears only on the printed overlay, not on the display.

We did not measure a real panel. Key sizes and the panel's height and width should be taken from an actual unit before the overlay is drawn to scale.

# 7: Testing plan

The redesign has not been tested with users yet. The plan is to give five people who rarely use a microwave the same three tasks, first on a real panel and then on the interactive prototype. The tasks describe a goal, not the buttons, so they test understanding rather than reading.

| Task | Real panel | Prototype |
|---|---|---|
| T1: "Your chai went cold. Warm it up." | | |
| T2: "Defrost this 500 g packet of chicken." | | |
| T3: "Reheat this dal at medium power for about a minute and a half." | | |

For each task we will note whether it was done without help, how long it took and how many wrong keys were pressed. The prototype keeps its own count of presses and wrong presses.

# 8: Limitations and conclusion

Some things were left out to keep the redesign small:

- Bake has no preheat stage, so a user could put a cake in a cold oven.
- The eight dishes have one default time each, with no portion size.
- Defrost by weight assumes the user knows roughly what the food weighs.
- Cost and the exact LCD layout were not worked out.
- Touch cues stop at the START bump and the STOP shape. Braille or larger tactile marks were not designed.

Current microwave panels confuse beginners because they show the machine's settings instead of guiding the user. The proposed panel keeps the same parts and price range but shows one clear order of steps, uses words instead of codes, cuts the keys from about 21 to 10, warns about containers and lets users undo mistakes. The next step is to run the tests in Section 7 and change the design based on what users actually do.

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