iSolved time clock
Value-added assembly

The challenge

iSolved, a US-based human capital management company, was developing a new series of wall-mounted time clock devices. The NXG G2 time clock is a next generation time-tracking device made for the workplace environment, that enables employees to register their work hours through various mechanisms, such as a magnetic card swipe, key code entry, barcode reader, or biometrics. Soon after designing the capacitive touch circuit and utilizing LEDs for backlighting with another vendor, iSolved started struggling with LED hotspots. They approached GM Nameplate (GMN) to develop a graphic overlay prototype that would primarily mask these hotspots and make the lighting even smoother.

However, after learning about the cosmetic and functional requirements of the project, GMN steered the winds of this project in a new direction by proposing fundamental changes to their backlighting and capacitive touch circuit approach. GMN soon realized that it could expand its realm of expertise from just overlays to offer a holistic solution. Unquestionably, iSolved joined hands with GMN to develop a value-added, cost-effective device.

Project goals

- **Develop a scratch-resistant overlay to mask LED hotspots**

- **Determine a backlighting solution to ensure uniform lighting**

- **Design a cost-effective capacitive touch circuit**

- **Assemble various components to deliver a complete solution**

The solution

During the prototype development phase for the graphic overlay, GMN wanted to get to the root of the hotspot issue, and investigated iSolved's backlighting system with the previous

vendor. It was discovered that iSolved had mounted approximately one discrete LED for every button on the time clock, which translated to a total of 14 LEDs. With extensive experience in the field of backlighting, GMN promptly proposed to replace the discrete LEDs with a light guide film that directed light via four right-angled LEDs. GMN's solution proved beneficial for three main reasons - (a) the light guide film utilized 71% fewer LEDs, making the device more cost-effective and leading

BENEFITS OF LIGHT GUIDE FILM:

☑ **UTILIZE FEWER LEDS**

☑ **UNIFORM LIGHTING**

☑ **NO HOTSPOTS**

to substantial power savings in the long run, (b) the light guide film ensured uniform and smooth lighting, and (c) it completely eliminated all of their hotspots.

While addressing the hotspot problem, GMN also learned that iSolved had utilized a copper flex circuit for the capacitive touch. GMN proposed yet another radical change by switching to a printed silver circuit. The new solution was less than half the cost of the copper flex circuit, resulting in further cost savings. To accommodate the printed silver circuit, the capacitive touch control microchip which was originally mounted on the tail of the copper flex circuit was moved to the motherboard. The printed circuit was then die-cut using a steel-rule die.

As a time-tracking device, the NXG G2 time clock would be exposed to constant use and frequent cycles of cleaning over its lifetime. Keeping this operating environment in mind, GMN opted for a screen-printed textured polyester for the graphic overlay with a clear top coating. Polyester, with its high durability and high chemical resistance, allows for millions of actuations without damaging the overlay. The clear top coating added another layer of protection, further equipping the overlay to withstand rough handling and abuse.

After mounting the graphic overlay on the capacitive touch circuit, the areas surrounding the circuit were relatively thinner and had to be brought to the same height. A black polycarbonate panel-filler effortlessly did the job of leveling the surface, and also prevented potential light leaks from the light guide film.

71%

REDUCTION IN NUMBER OF LEDS

65%

COST SAVINGS IN CAPACITIVE TOUCH CIRCUIT

The panel filler was first mounted on the overlay and then they were die-cut together in the required shape. However, given the thickness of the overlay and panel filler, a steel-rule die would have proved ineffective, so a laser cutter was used to complete the task more efficiently, ensuring clean and crisp edges.

As the project progressed further, GMN brought even more of its capabilities under the umbrella including a LCD display and a projected capacitance (PCAP) touchscreen. The two

critical layers were integrated using an air-gap bonding technology. A popular bonding capability for handheld devices, air-gap bonding uses a framed VHB adhesive gasket that leaves behind an air gap in the stack-up. Since the time clock was an indoor device, it wouldn't be exposed to prolonged sunlight or moisture condensation, so the air-gap technology met all the functional requirements of the device. It was also lower in cost as compared to other bonding methods such as optically clear adhesive (OCA) and liquid optically clear adhesive (LOCA). Additionally, the PCAP touchscreen provided excellent optical performance, superior durability, and unlimited touch possibilities.

☑ **GRAPHIC OVERLAY**

☑ **BACKLIGHTING**

☑ **CAPACITIVE TOUCH**

☑ **LCD DISPLAY**

☑ **TOUCHSCREEN**

☑ **DIE-CUTTING**

☑ **MEMBRANE SWITCH**

After the completion of the NXG G2 time-clock, iSolved decided to develop yet another time clock in the NXG series. This second time-clock was a no-frill device offering only the basic functionalities with a tactile membrane switch and LCD display. With a firm grip on the project needs and requirements, GMN breezed through the prototyping of this device by making appropriate modifications to the circuit traces and replacing the graphic overlay with a membrane switch.

The iSolved project clearly portrays how GMN can bring its varied capabilities together to streamline the supply chain and deliver a complete solution under a single roof. With GMN's one-stop-shop custom manufacturing abilities, a project that initially took off as a small prototype order for graphic overlays eventually ended up bringing our diverse capabilities together including graphic overlay, backlighting, capacitive touch circuit, die-cutting, screen printing, LCD display, tactile membrane switch, and touchscreen.