Harbor Research was recently given the opportunity to examine a new software platform that takes a refreshingly new approach to integrating augmented reality (AR) and artificial intelligence (AI) in a comprehensive offering that better enables manufacturing and services industry workers to perform their jobs.

Augmentir leapfrogs the current Enterprise AR market’s noise, clutter, and failures by cleverly unifying core work-instruction and process-development tools with AI and machine learning in a single, scalable solution. In so doing, Augmentir is re-defining the concept of augmented reality for the enterprise and creating a new market meta-category.
THE INVISIBLE, FORGOTTEN WORKER

In the last ten years alone, countless billions of dollars have been invested in cloud technology, networking infrastructure, computing hardware, and software platforms to revolutionize the manufacturing and service enterprise. Until recently, few of these investments have been directed to support the activities of the hands-on or frontline workforce. Entrepreneurs with long experience in industrial software describe these frontline workers as the “forgotten component” of the enterprise, people hidden from view as if by a “cloak of invisibility.”

Enterprise Augmented Reality is one example of a new class of technology aimed directly at enhancing the experience and output of workers in manufacturing and service. This market was created when wearable computers/smart glasses and augmented reality emerged as technologies that offered the promise of delivering live information to front-line workers in an immersive manner to be consumed hands-free. But despite the ubiquitous marketing images of people in smart glasses and VR goggles, Enterprise AR has had trouble gaining traction beyond test-pilots.

In part, this has been due to poorly implemented software solutions and early hardware that didn’t perform to the comfort, safety, and reliability expected by the users. This was further exacerbated by high costs and long implementation cycles that plagued the early suppliers of Enterprise AR solutions. Even more importantly, once the solutions were finally deployed, it became obvious that the software failed to provide value beyond the initial one-time gain in productivity, which frequently was in use-cases where hands-free operation was the real source of the benefits derived.

In fact, the initial Enterprise AR solutions offered too narrow a value proposition. In all the case studies that Harbor has examined, the efficiency improvements and elimination of quality defects that companies have achieved with Enterprise AR has been due merely to workers having instructions available hands-free. There’s little to no IP in the Enterprise AR space that’s designed to deliver value beyond just pushing instructions to workers. None of the study participants, including major manufacturers like Boeing or AirBus, has ever said, “This software helped us identify areas where we could continually improve our operations.”

Enterprise AR, at least as it’s been conceived of so far, focuses only on delivering instructions to the worker, not on collecting data about the work from this newfound connectivity to the worker. If you could make the leap to seeing workers as a new source of information about your processes, and if you analyzed that data with
an AI engine to create insights into every aspect of their productivity and training, you could benefit the entire organization.

That’s the vision of the category-creating company called Augmentir.

ENTER AUGMENTIR

Augmentir is a new startup founded in 2017 with the mission of delivering enhanced productivity in manufacturing and service by targeting the efficiency of front-line workers. Augmentir’s founders are a seasoned team of entrepreneurs who have repeatedly leapfrogged existing markets to deliver winning ideas in manufacturing and software. For more than thirty years they have blazed the trail of “software eating the factory,” starting with Wonderware (IPO Nasdaq) which started that trend, to Lighthammer, the first enterprise-level manufacturing intelligence platform (acquired by SAP), and finally to ThingWorx (acquired by PTC), an IIoT pioneer that extended their work outside factories to connecting smart equipment and devices.

Now, with Augmentir, they are pursuing the last great overlooked area in factories and service: the role of hands-on assemblers, technicians, and service personnel. Companies have invested all around the frontline worker, but they’ve never invested in the worker as a key member of the organization. “They’ve never brought the digital journey to the workers themselves,” says Russ Fadel, Augmentir’s CEO. “Our vision is to deliver the benefits of AI directly through enterprise AR. That’s why we’re calling our platform ‘Augmented Operations.’ We use AI to optimize everything from how you write instructions for workers, to how those instructions are executed, to how additional stakeholders like the training department transform the way they work to improve the entire organization. We see a very broad opportunity here.”

AUGMENTIR’S INNOVATIONS

While data from machines have made industrial processes more productive over time, no one has attempted to close the measurement loop by instrumenting the most variable element in the whole process, the human worker. Augmentir’s platform embodies three core innovations:

» A new way of authoring, managing, and optimizing fully augmented work instructions and step-by-step procedures for frontline workers. Augmentir uses AI to help authors get fully augmented instructions—from initial
transforming industry with augmented operations

authoring to production—10X faster than previous approaches. AI is also used to personalize instructions to each worker based on their proficiency, optimizing each worker’s efforts while still meeting quality and safety targets. And Augmentir allows these instructions to be authored in a “write once” procedure that runs optimally on tablets, phones and smart glasses.

» Using AI to automatically identify the largest capturable opportunities across the frontline workforce. Augmentir sees workers and their connected tools as a new source of data that can be used by their AI engine to support continuous improvement efforts. With the noisy signals generated by humans, only AI/ML can recognize the patterns in the data allowing Augmentir to stack rank the largest opportunities in productivity, quality, training, and content development, and provide insights into how to capture them across the entire organization.

Augmentir’s AI Platform

» Augmentir delivers these technology innovations through a modern, enterprise software platform. Many of the enterprise AR suppliers followed the traditional enterprise software product and GTM model, making the
product license and pilots very expensive. Augmentir chose a modern SaaS-based enterprise software approach that is easy to try, buy and own. This approach, pioneered by companies like Slack, reduces IT support requirements and allows pilots to be much less expensive than traditional enterprise software can approach. This makes Augmentir suitable not only for large enterprises but also for small- to mid-sized businesses that make up fully 50% of the available market. The intuitive user experience and easy-to-try model lets companies get into pilot or production within days, and start getting actionable intelligence after only a week or two of data-gathering.

**INTRODUCING AUGMENTED OPERATIONS™**

This new concept is what Augmentir calls “Augmented Operations.” In its most basic sense, Augmented Operations uses AI/ML to deliver intelligence and value across an entire organization directly from its augmented workforce. In our analysis of Electronic Work Instructions (EWI) and Enterprise AR vendors, we see this as a step-change beyond traditional EWI and Enterprise AR. The result is transformational value in how organizations make informed decisions, empower workers, and improve the productivity of humans in the workplace.

**Augmenting Front-Line Workers**
Augmentir’s AI-powered Augmented Operations platform is able to continually deliver insights and recommendations based on analyzed human worker data. This valuable intelligence can be used to help drive continuous improvement across the entire organization, from operations to training to quality.

» AI can help each worker perform at their peak, dynamically changing the instruction to match the proficiency of each worker and allowing them to perform their job as fast as possible, while meeting quality and safety targets

» AI understands the patterns and outliers in a vast set of high-granularity job-execution data. This allows Augmentir to identify the largest capturable opportunities in the areas of productivity, worker effectiveness, training materials effectiveness, and instruction effectiveness. The net result is new insights and recommendations for capturing these opportunities. Due to the noise embedded in human generated data, AI is the only way to deliver the actionable information required for industrial organizations to drive continuous improvement on a year-over-year basis.

Augmented Operations Maturity Curve
» With AI, companies can optimize troubleshooting / diagnostic procedures by observing the attempts and results of technicians in the field.

» With AI-bots, companies will be able to capture tribal knowledge by participating in the interactions between experts and frontline workers. Over time, this makes the expertise / tribal knowledge a scalable corporate asset.

THE DIGITAL JOURNEY and THE AUGMENTED OPERATIONS VALUE CURVE

Industrial customers derive both immediate and ongoing value from using Augmentir and Augmented Operations. During our examination of Augmentir, the team shared their “Augmented Operations Value Curve,” which was modeled from some of their early customer successes.

Immediate benefits come as soon as a company moves its legacy paper-based work instructions into “augmented instructions.” Your work-process instantly becomes alive and interactive, rather than simply inert “paper on glass” PDFs. Further, Augmentir’s drag-and-drop interface makes the authoring process as painless as possible. And thanks to the company’s designers’ deep manufacturing and service experience, the platform’s smart templates anticipate many typical actions that frontline workers perform during a job.

This model allows Augmentir to serve even the smallest organizations. For most small- to mid-size companies, it’s a big step to go from paper instructions to digital. Augmentir helps them capture their knowledge and write systematic

ENABLING CONTINUOUS QUALITY IMPROVEMENTS:

BIO•CHEM FLUIDICS

Bio-Chem Fluidics, a mid-size manufacturer of high-performance pumps and valves for clinical diagnostics and analytics chemistry applications, is striving to meet increasingly stringent safety, quality and regulatory requirements in every step of their medical device’s life cycle.

Bio-Chem Fluidics has been challenged in their evolution to lean manufacturing because they collect very limited data regarding their assembly operations’ quality performance. Before Augmentir, the company’s data collection reported only on a given assembly’s job-start and job-end. Without more granular data from their assembly operation, they had no way to identify areas for improvement, and to ensure that they could achieve ISO quality standards and compliance requirements.

AUGMENTIR VALUE

With Augmentir’s Augmented Operations platform, Bio-Chem Fluidics was able to:

» Move from paper-based to interactive augmented instructions for assembly and QA procedures

» Collect and provide insights on the granular assembly data required for their lean manufacturing initiatives and increasingly stringent regulatory requirements

» Drive quality improvements through validation of critical assembly steps

» Provide built in “training” for less experienced assemblers and temps

» Reduce training time by over 80% (from three months down to two weeks)
instructions, which they find provides tremendous value. It moves companies to standardized work, which in itself helps with quality. Once they use Augmentir enough, the software helps them identify which workers are excelling and which workers could benefit from additional training, so the organization continues to improve quality and productivity.

“We don’t see anyone else thinking about this the way we are,” says CEO Russ Fadel, “and this is probably because the Enterprise AR vendors started years ago when it wasn’t obvious that helping frontline workers is a problem that AI could solve. Most vendors still seem to think they have delivered all their value when they get the first instruction running on smart glasses or mobile devices for a worker. But we think of that as the starting point of the Augmented Operations Maturity Curve. Our motto is ‘We see beyond standard work to where all of the opportunities are ahead of you.’”

**HOW AUGMENTED OPERATIONS DELIVERS VALUE**

Augmentir views its platform as your company’s partner on the digital journey. Wherever you may be on that path, you can benefit immediately from Augmentir’s AI/ML engine, and then see increasing benefits over the long term as it suggests incremental improvements to your training, content development, productivity and quality of product or service, including:

**Support workers where and when the work actually happens**

» Augmentir reliably guides workers to improve their overall productivity and quality. Its always-available contextual information provides a first level of support that improves worker effectiveness without the need to interrupt other more experienced workers.

» Augmentir’s Remote Expert (“Assist”) support is always one click away. This next level of support enables your in-house experts to become force-multipliers. Less-experienced workers always have access to an on-call support structure.

» Augmentir converts hard-to-capture “tribal knowledge” into routinized training procedures that become true corporate assets. Your company centralizes mindshare and builds a knowledge-base for training and organizational improvement.

» Augmentir lets you embed QA and compliance directly into augmented procedures. These can include digital QA signoffs, data capture, and automatically generated digital audit trails.
Augmentir delivers more effective training in any manufacturing or service context. Its in-line and “last minute” instruction fills knowledge gaps and leads to much better retention than personal study or classroom training done away from the job.

Augmentir drives continuous improvement throughout your entire organization. The platform’s embedded AI/ML engine helps accelerate continuous improvement and digital transformation.

Stream data from workers, devices, and sensors into the AI/ML engine

Humans generate noisy signals, and until now no one has done continuous systematic assessment of the procedures that factory workers are expected to carry out, or real-time data-analysis of their actual performance. While companies might do an annual Kaizen week or 5S analysis with time/motion studies, these are expensive, one-off events that might offer one-time incremental improvements, but don’t offer continuous assessment that encourages sustainment of those improvements with a detailed data-feed for AI/ML-based continuous improvement.

In short, Augmentir sees the worker as a new source of data for driving continuous improvement throughout the entire organization. Augmentir’s software streams data from any activity a worker performs, along with any connected tools they use, back into the system to be used to identify opportunities for better procedures, better tools, better training, and other areas to save time and money.

**SYSTEMATICALLY CAPTURING FRONT-LINE WORKER KNOWLEDGE**

**STRONGARM**

STRONGARM, a Pennsylvania-based manufacturer of operator interface systems and industrial displays, was manufacturing expensive assemblies with undocumented procedures known only to a few long-term employees. The company’s engineers were following hand-drawn visual schematics for complex builds, while trying to communicate with a separate team of co-workers in another building. STRONGARM needed capture tribal knowledge from aging employees, systematically document assembly processes with step-by-step instructions, and create training modules for less-experienced hires.

**AUGMENTIR VALUE**

Augmentir’s AI-driven platform is enabling STRONGARM to capture precious information that was until now “locked in the heads” of engineers and assembly-line workers. Augmentir’s value includes:

» Collecting tribal knowledge from an aging workforce, and documenting step by step instructions.

» Driving quality improvements through validation of critical assembly steps

» Creating built-in “training” for new incoming less experienced assemblers/engineers

» Enhancing their company-wide continuous improvement initiative by delivering AI-curated true opportunities which enables them to focus on the areas of largest opportunities
OPTIMIZING MANUFACTURING and SERVICE TECH PERFORMANCE

HOLT CAT, Caterpillar’s largest heavy equipment dealer, sells, services and rents Cat equipment in Texas. HOLT has a long history of innovation, including the invention of what is known today as the “caterpillar” tractor, a machine with a crawler-type tread that revolutionized farming and led Benjamin Holt to found The Holt Manufacturing Company.

Continuing HOLT’S commitment to embracing new innovations, the company has adopted Augmentir’s platform to help drive consistent quality, efficiency, and higher productivity within their turbocharger remanufacturing facilities—including inspection, repair, scrap, and rebuild processes.

HOLT’s technicians are utilizing Augmentir to improve their repair and rebuild processes with augmented work instructions and the latest electronics tech to enable fast and accurate troubleshooting and repairs.

AUGMENTIR VALUE
HOLT CAT was able to deploy Augmentir’s platform very quickly with these results:

» Up and running in 3 days
» Producing valuable data within 7 days
» Improved efficiency and job tracking
» System allows technicians to provide feedback on the process thorough comments and photos
» AI-driven insights highlight areas of process and data improvements

Business-system integration
Augmentir seamlessly integrates with business systems including SAP, Oracle, Salesforce, Infor, and more. It also integrates with traditional IoT and sensor systems like ThingWorx, Azure IoT Hub, and beyond. Front-line workers can start and end tickets generated by these systems, ensuring that the workers are fully involved in the digital thread of the business. Finally, all the data from all the stakeholders is fed back into Augmentir’s AI/ML engine to identify the best opportunities for improving a company’s business year after year.

Help companies move more quickly
When an organization builds an assembly procedure or a service procedure, they don’t immediately put it into production. They send it out and let workers test it, and at certain points workers inevitably say, “I don’t understand this step, that step’s incorrect, it would be better if these were two separate steps, it would be faster if these two steps were together.” There’s an iterative process to take a new procedure and get it signed off for production. Augmentir offers tools that not only help companies author instructions more quickly and correctly the first time, but also help keep production procedures current over their life-cycle.

Partners can add new value into Augmentir
Augmentir was designed as a true platform where 3rd parties can extend, enhance, and verticalize it to reduce time-to-value for our customers. Partners are building vertical-specific end-to-end solutions for verticals where they have expertise, such as reliability centered maintenance, machine shops, injection molding, HVAC service, and other industrial use cases. Ultimately this increases the pool of developers that are improving the Augmentir platform, making it more valuable to end customers.
Augmentir’s initial use cases

In manufacturing, Augmentir is targeting opportunities that range from inbound inspection, assembly, QA, certification, ISO compliance.

For product manufacturers, Augmentir uniquely targets installation, which presents unique challenges when the installer is a dealer, a 3rd party service organization, or a customer. The Augmentir runtime is designed so that manufacturers can rebrand it with their own logo, thus extending their identity anywhere in the value chain.

In service and support, the basic opportunities are classic diagnostic, preventive maintenance, and repair.

CONCLUSION

Radical new thinking about UX-UI technologies for enhancing and optimizing frontline work roles must begin at the most basic levels, with new conceptions about the interactions of information with people, systems and devices. Augmentir’s creative combination of multiple technologies takes a much broader, all-encompassing view of worker augmentation than has ever been achieved before. Ultimately, this type of platform solution will alter traditional business models and how new operations work is realized.

All of today’s Enterprise AR players have historically operated within pre-established assumptions about product scope and business models. Though their models are intermingling, no one would characterize the existing players as radical innovators or technologically disruptive. By contrast, what we’ve described in this paper is a pronounced departure from current practice. It’s been created by a team with a unique perspective on manufacturing and services, and an ear for emerging technologies like connected tools and AI-driven analysis.

Augmentir is a category-creator, and should not be evaluated within the narrow specialties of existing players. This is particularly true given the disjointed patchwork of AR technologies presently in place, and the apparent lack of vision from existing players. The opportunity to lead in developing and shaping this market looks wide-open to players like Augmentir because they offer immediate value today while anticipating tomorrow’s challenges.
ABOUT HARBOR RESEARCH
An internationally recognized strategy consulting, design and technology research firm, Harbor Research has predicted, tracked, and driven the development of Smart Systems, Services and the Internet of Things since our inception in 1984.

While our history is long, our strategy is simple: create value for our clients by combining creative facilitation with structured methods, rigorous analysis and systems-focused thinking. It is this mindset that has given us the privilege of working with leaders in some of the greatest companies in the world. We work with clients in a variety of ways including growth strategy consulting, business model development, and solution design services supported by our independent research focused on emerging technologies and human sciences.

THOUGHT LEADERSHIP
We provide our clients with rigorous analysis and unique insights to support the development of new growth strategies and solutions. Our research, content and modeling work provides an ideal context for discovery and ideation. We combine market intelligence with creative decision making forums in a mutually supportive mode.

UNIQUE PROCESSES
There is no simple “linear” process to drive new smart systems innovation. Iterative, nonlinear methods are important because design innovation is a process of exploration and discovery. Our methods facilitate new thinking and unexpected concepts and ideas that drive tangible customer and market impact.

VIBRANT COMMUNITY
Building new smart systems and digital growth ventures requires new and different modes of design, development and collaboration. We tap our community of innovators and thought leaders to help organizations push the boundaries of collaboration to include new and unfamiliar participants that help foster new insights and creative perspectives.

At the core of Harbor’s approach is a deep and thorough understanding of the core technologies, market and business characteristics as well as the management and organizational challenges companies face developing or adopting digital and smart systems technologies.