How to Build Products with TinyML and Sensors

*TinyML Talks - 29 September 2020*

*Presented by Stuart Feffer, co-founder + ceo, Reality AI*
Reality AI is for building products
What’s the difference between building products and doing projects?
Certainty and Scale
Building products ≠ Building models
Building products vs doing projects

Products must:

- Work everywhere, for everyone, all the time, not just for me
- Be explainable and convincing to engineering, operations, manufacturing, marketing, customer support, and executive management, not just to the data scientists
- Use components sourced through a supply chain, not a dev kit
- Meet unit-cost targets for Bill-of-Materials (BoM) and manufacturing, not hand assembled
- Work within constraints for size, weight, power consumption, heat, etc.
- (Often) avoid open source for intellectual property and liability reasons
**Reality AI Tools® 4.0**

**AI Explore™**
Automated Feature Exploration and Model Generation
- AutoML (no coding)
- Explainability

**BOM Optimization**
Use AI to find the most cost-effective components
- Cost-optimized specifications
- Minimum sensor set

**Data Readiness**
Understand the state of training and testing data
- Automated
- Consistency
- Quality
- Coverage

**Edge AI / TinyML**
Super-compact, efficient code for the smallest MCUs
- Embedded code generation
- Ease of deployment

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Case Study: Condition Monitoring for an Industrial Blower

Objective: Detect blockages and other conditions

Phase 1: Prove feasibility

Phase 2: Design product

Phase 3: Complete product development and prepare for manufacturing / distribution
Phase 1: Prove feasibility

Approach:

- One test unit
- IoT dev kit w on-board accelerometer
- Mount in the most likely location
- Collect small amount of data in normal and failure modes
- Generate and test an ML model with Reality AI Tools®
- Explain results to the boss and to engineering

Quick. Low cost. Good result could justify further effort.
Reality AI Tools® 4.0 Demonstration
Part 1 - AI Explore

- AutoML
- Explainability

DEMONSTRATION
Phase 1: Prove feasibility

Results:

Is it possible? ✅
Can I explain it? ✅
Is it worth proceeding to product development? ✅

Our project was successful! Time to build a product.
Phase 2 - Design the product

Phase 2 questions are all about hardware:

- How many sensors?
- Where to mount them (most accurate and cheapest to manufacture)?
- Minimum component specs?

Phase 2 approach:

- Multiple test units
- Multiple environmental conditions
- Lab grade sensors, very high sample rates
- Reality AI Tools® to optimize choices and set specs
Best sensors? Best location?

Mounting locations for Phase 2 data collection:

Accelerometers:
- Intake grill
- Chassis
- Motor

Thermocouples:
- Intake grill
- Outflow duct
- Motor

In the final product we want to use as few channels as possible. But which ones?
Reality AI Tools® 4.0 Demonstration

Part 2 - BoM Optimization

- Cost-optimized specifications
- Minimum sensor set
Phase 2: Design the product

Results:

Can we build it?  ✅
Is cost within limits?  ✅
Will it work?  ✅

Time to build test units and collect data for a production model!
Phase 3: Build production ML model

Phase 3 objectives:

Achieve statistical confidence that our product will work everywhere it should:

- Full diversity of customer implementations and environmental conditions.
- All unit types (models, sizes, etc) of similar construction.
- Every unit, regardless of small manufacturing differences or other details.

Then complete the firmware build.

Need a lot of data for training and testing.
A lot.
What’s the best way to control the cost of data collection?

Only do it once.
Reality AI Tools® 4.0 Demonstration

Part 3 - Data Readiness

- Automated
- Consistency
- Quality
- Coverage

DEMONSTRATION
Reality AI Tools® 4.0 Demonstration
Part 4 - Edge Deployment / Integration

DEMONSTRATION
Objective: Detect blockages and other conditions

Phase 1: Prove feasibility ✅
Phase 2: Design product ✅
Phase 3: Complete the development ✅

Product development is complete! Ready for manufacturing & distribution.

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Get Started with Reality AI

*Special TinyML Talks offer*

60-day Rapid PoC

100% Risk Free

*For TinyML Talks attendees only*

[info@reality.ai](mailto:info@reality.ai) for more information
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