March 23, 2021

Revolutionizing Preventative Maintenance Checks and Services with Augmented Reality

Ms. Charis Horner Product Engineer

Design Interactive, Inc.





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Vehicle Maintenance and Multi-Domain Operations

- Vehicle maintenance is critical to Army operations
 - Increasingly so with emphasis on multi-domain operations (MDO)
- MDO requires wide range of Army & Joint capabilities
 Land domain must be ready to deploy at a moment's notice
- MDO increases importance of mission ready and deployable vehicles

Preventive Maintenance Checks & Service (PMCS)

- Many existing maintenance processes are analog
 - Reliant on paper-based forms and manuals
- Example: PMCS
 - Dependent on potentially damaged or misplaced paper manuals
 - Limited visibility into vehicle maintenance history
 - Fault escalation relies on easily damaged, lost, or indecipherable forms

The Battalion needs a way to aid PMCS and accelerate fault escalation from days to hours and minutes, getting vehicles up and running faster



Augmented Reality (AR) as Enabling Technology

- AR has been shown to immensely benefit maintenance applications
 - Reduce errors, execution time, downtime, and cost
 - Increase productivity, efficiency, compliance, and readiness



Opportunity: Update paper-dependent PMCS to a digital AR platform, enabling efficiencies in **inspection**, **fault escalation**, and **validation** thereby **reducing PMCS from days to hours and minutes**

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Digital Repair, Inspection, Validation Environment (DRIVE)

- Soldier-inspired solution providing 21st century update to PMCS
- End-to-end AR solution providing vehicle history, digital fault escalation, and step-by-step procedural guidance
 - DRIVE results in an expected 60% increase in efficiency during individual inspections
 - Designed to alleviate frustrations with paper-based processes
 - Introduces point-of-need AR support
 - Gets vehicles up and running faster

Solution Development

- Employed a rigorous design
 - Ensured solution **empowered** Soldiers
- Key Activities:
 - Field Study conducted at Ft. Hood
 - End User Interviews
 - Application of Human Factors and Cognitive Science Principles
 - Low and High-Fidelity Mockups
 - Usability and End User Evaluations







RECIEVE Q³ (≳) SGT Reed ↓ Support ← Back DRIVE Work Order #3432534 on M1A1 Abrams Tank #2543 MAINTAINER REVIEW Dashboard Review Faults Inspection Guide Summary History **IDENTIFY** 📴 Inspection Log Faults Fault Verified? * C Vehicles Reject Verify ☐ EXTRACT[™] Guide Library Fault Severity **VERIFY** Faults Enter Corrective Action * NSN/NIN Association * Select NSN/NIN Code VALIDATE Faults 0:00/0:00 (+) Another Corrective Action Send to BMO Θ SAVE & LOG Item 2 Item 1 Item 3 Previous History

RECIEVE Support

IDENTIFY Faults

VERIFY Faults

VALIDATE Faults

SAVE & LOG History

DRIVE	Welco	Velcome Back 1LT Poole!			
B Dashboard ☐ Inspection Log	3 New Deadline for Review	d Faults	8 Known Faults	()	18 Inspections Re In October
🕞 Vehicles	New Inspe	ctions For F	Review		
EXTRACT [™] Guide Library	Inspection	#	Vehicle #	Faults Verifi	ied Da
🗙 Users	343254534	343254534		3	10,
	54645754	546457547		2	10,
	09856738	9	4329	1	10,
	Known Fau	ilts			
	Fault Code	Component	Vehicle #	Work Order #	Date
	10-W	Tire	2543	343254534	10/06/20
	2-M	Brake Pad	4329	08374395	10/06/20
	2-W	Alternator	4435	453023955	10/05/20
	2-M	Track	5467	454356346	10/05/20



Applications, Limitations, and Future Work

- Applications
 - Army vehicle maintenance PMCS
 - Commercial vehicle maintenance
 - Any maintenance area with need for fault escalation
- Limitations
 - Requires use of tablet
 - Integration with external systems
- Future Work
 - Full system implementation and on-site evaluation

Questions/Discussion



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The effort depicted is supported by the U.S. Army Research Office. The content of the information does not necessarily reflect the position or the policy of the Government, and no official endorsement should be inferred.

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Contact Information

Charis Horner Product Engineer XR Division Design Interactive, Inc

Charis.Horner@DesignInteractive.net 904-226-0224





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