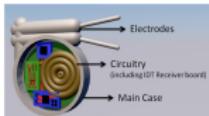
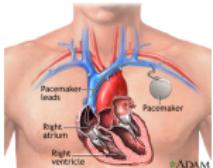




## Why this course?

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**FIG 1.** A pacemaker is a small, battery-operated device. This device senses when your heart is beating irregularly or too slowly. It sends a signal to your heart that makes your heart beat at the correct pace. In general, a heart pacemaker contains a small micro-controller and electrodes that connect the heart to the generator. The electrodes carry the electrical message to the heart. A defective pacemaker can cause more harm

**TAB 1.** Embedded system programming paradigms

	■ simple processors	
Bare metal <sup>1</sup>	■ simple devices ■ few operations ■ you already know this ■ devices with multitasking	
RTOS <sup>2</sup>	■ strict deadlines ■ powerful processors ■ complex devices ■ very complex application	
Embedded Linux <sup>3</sup>	■ file-systems, networking ■ Pretty UI	

<sup>1</sup><https://www.embeddedrelated.com/thread/5762/rtos-vs-bare-metal>

<sup>2</sup>[https://en.wikipedia.org/wiki/Real-time\\_operating\\_system](https://en.wikipedia.org/wiki/Real-time_operating_system)

<sup>3</sup>[https://en.wikipedia.org/wiki/Linux\\_on\\_embedded\\_systems](https://en.wikipedia.org/wiki/Linux_on_embedded_systems)

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## Why this course?

■ How can we prove that an unmanned aerial vehicle (UAV) will brake quickly enough if it encounters an object on its path?

■ The possibility of life-or-death decisions being taken by an UAV not under the direct control of humans needs to be taken seriously

■ In short, how do you know that a UAV military drone will work as expected?



**FIG 2.** General Atomics MQ-9 Reaper  
The MQ-9 is the first hunter-killer UAV designed for long-endurance, high-altitude surveillance. It is capable of remotely controlled or autonomous flight operations and is primarily for the United States Air Force (USAF).

<sup>1</sup>[https://en.wikipedia.org/wiki/General\\_Atomics\\_MQ-9\\_Reaper](https://en.wikipedia.org/wiki/General_Atomics_MQ-9_Reaper)

<sup>2</sup>[https://en.wikipedia.org/wiki/General\\_Atomics\\_MQ-9\\_Reaper](https://en.wikipedia.org/wiki/General_Atomics_MQ-9_Reaper)

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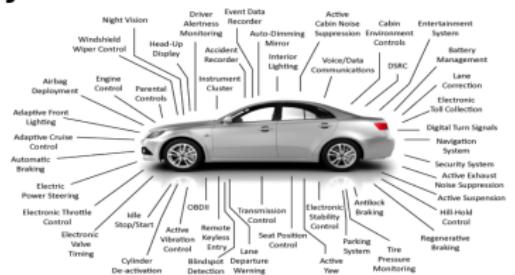


FIG 3. Embedded controllers found in a modern vehicle

- <sup>1</sup>Should we be worried that our cars are controlled by software?  
<sup>2</sup>How Software Is Eating the Car—The trend toward self-driving and electric vehicles will add hundreds of millions of lines of code to cars. Can the auto industry cope?

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# Why this course?

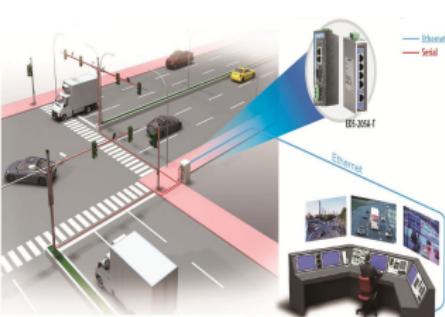


FIG 4. Traffic lights—How do you guarantee that cars won't clash into each other?

# Why this course?

## WIRELESS IMPLANTABLE MEDICAL DEVICES



FIG 5. implantable medical devices—Fatal consequences if they fail to work as intended

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# Why this course?



FIG 6. Artist's conception of NASA's Mars Exploration Rover on Mars. Its mission almost failed due to priority inversion.

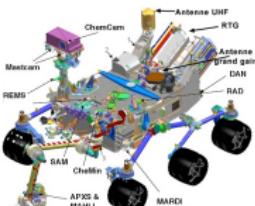


FIG 7. Instrumentation of the Mars Rover

# Why this course?

- It's a fundamental course on embedded system<sup>45</sup>
- In this course, we explore scheduling questions like these
- The course teaches provable guarantees of timing constraints for applications including autonomous vehicles.
- The course will explore timing constraints, both when programs have static priorities and when priorities can change over time.
- The course will also explore both theoretical and practical challenges introduced by modern embedded systems with multiple processors.
- **The course will be challenging**—but it will serve as a cornerstone for your future career in embedded systems.

<sup>4</sup>Please read this book for an extensive list of what you need to know as an embedded engineer Edwards, L. (2014). So You Wanna Be an Embedded Engineer: The Guide to Embedded Engineering, from Consultancy to the Corporate Ladder. Newnes.

<sup>5</sup>Steve Proenneke gives a succinct summary of what you need to know as an embedded engineer at this blog

<https://www.embeddedrelated.com/showarticle/1324.php>

The end