Micro-Electromechanical Systems (MEMS) Technology and Its Application in Smart Bullets

Made by: Mohialdin Eldirdiri

Outlines

- Introduction to MEMS
- MEMS Components
- How MEMS Works
- Applications in Various Industries
- Real world application – Smart bullets
- Why the need for smart Bullets
- Extreme Accuracy Tasked Ordnance Live-Fire Tests - Video
- Conclusion
- References

Introduction to MEMS

What is MEMS?

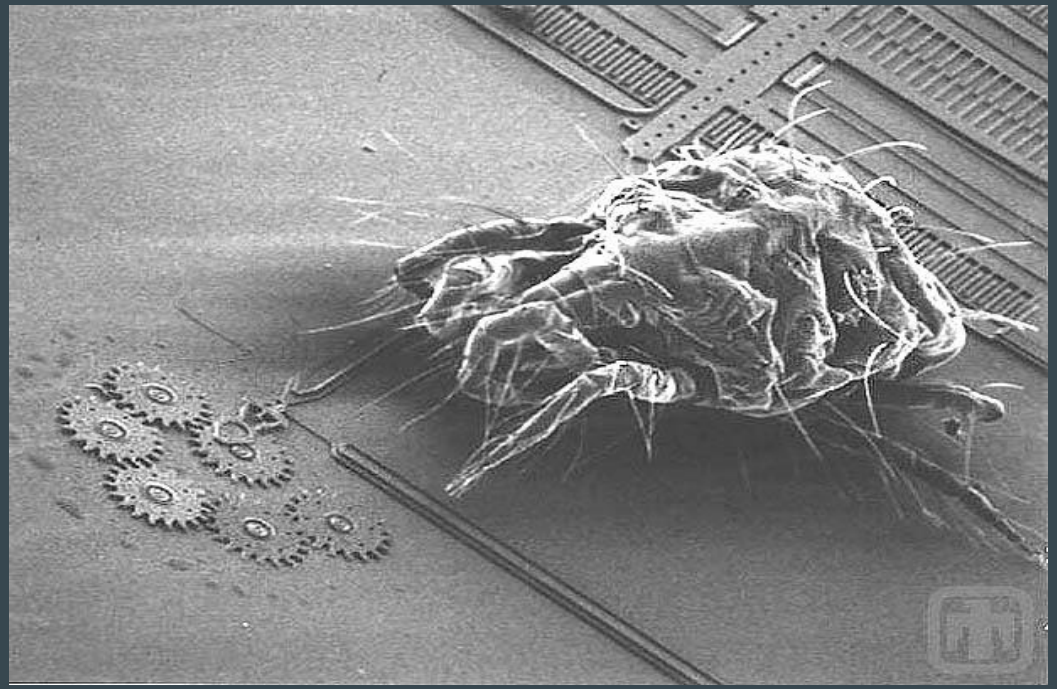
MEMS is the technology of microscopic devices incorporating both electronic and moving parts and MEMS devices are very tiny, Generally range in size from 20 micrometers to a millimeter, although components arranged in arrays.

MEMS components

MEMS Components Diver into two categories:

- Electronic:
    - Sensors (such as pressure, accelerometer, gyroscope).
    - Actuators (such as piezoelectric, electrostatic).
    - Microcontrollers.
    - Signal processing circuits.
- Mechanical:

    such as: Microgears, Microbeams, Membranes, Cantilevers, Springs



The relative size of the MEMS gears and a mite

HOW MEMS WORK

MEMS combines tiny mechanical part (like gears and beams) with electronics on a single chip. Sensors detect physical changes (like motion or pressure), Electronics process the signals, and actuators respond turning electrical signals into mechanical movement.

Applications in Various Industries

MEMS Applications includes Areas such as:

- Automotive: triggering Airbags in a car crash, etc.
- Medical: In monitoring vital signs, deliver precise doses of medications, etc.
- Consumer Electronics: Rotating the screens on smartphones, etc.
- Aerospace: Helping navigate aircraft and spacecraft, etc.
- Industrial: Enabling robots to sense position, Control precise movements, etc.

Real world application – Smart Bullets

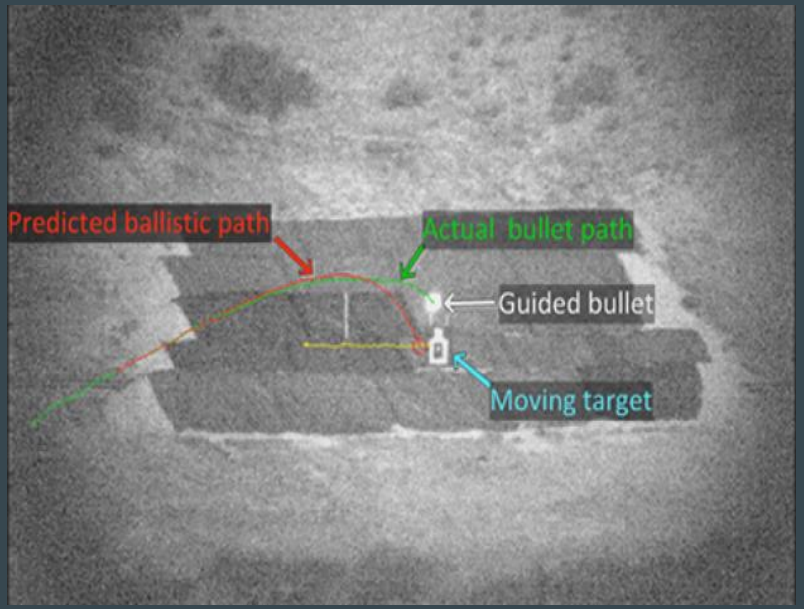
- A Smart bullet is a bullet that is able to do something other than simply follow its given trajectory, Such as turning, changing speed or sending data.
- Such a projectile may be fired from a precision-guided firearm capable of programming its behavior, It is a miniaturized type of precision-guided munition.

TrackingPoint XS1 - Precision guided firearm

Why the need for smart Bullets

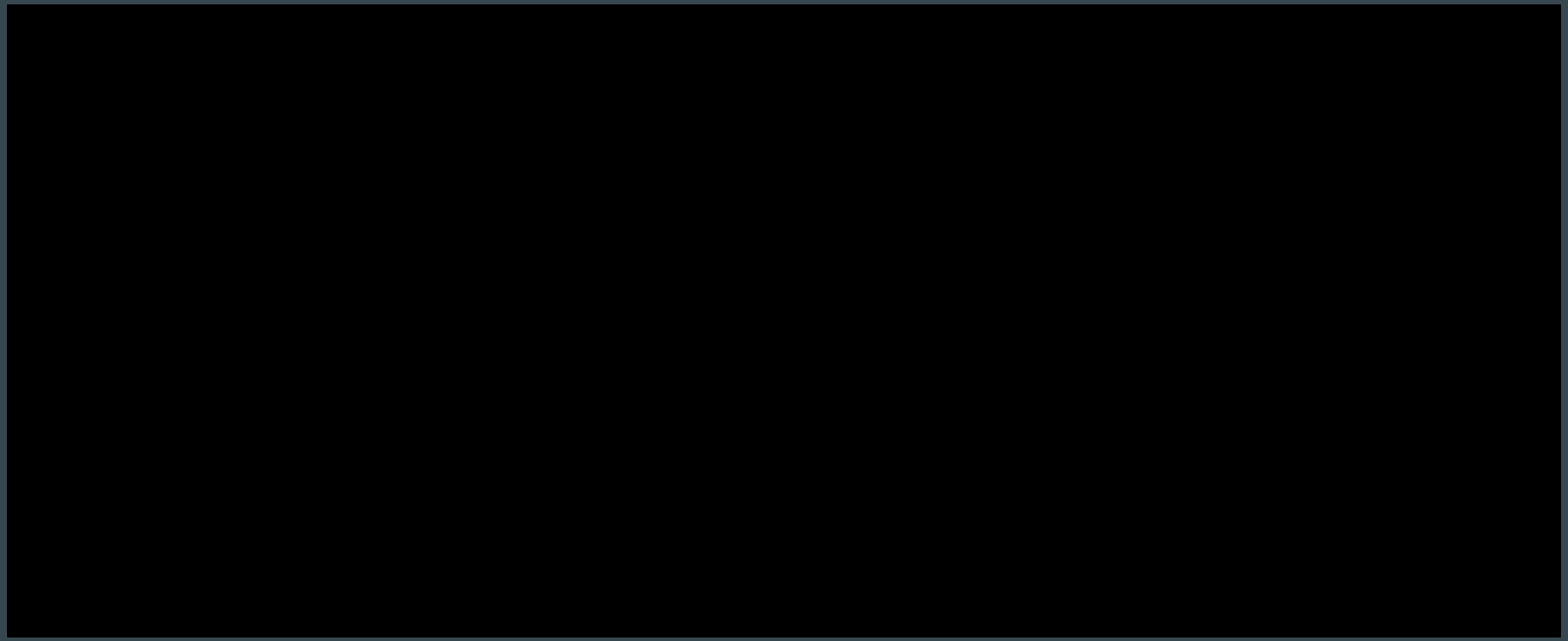
- Improve accuracy.
- Reduce collateral damage.
- Increase effectiveness in complex missions.

In general smart bullets enables soldiers to stay behind protective cover and shoot around corners, and also Allowing targets to be hit precisely even under difficult conditions like wind and long range.



DARPA's Self-guided Bullet Tests

Extreme Accuracy Tasked Ordnance Live-Fire Tests - Video



Conclusion

MEMS Technology is involved in almost everything we interact with in daily bases from cars, homes, phones and also extends to more bigger innovations such as smart bullets, showing us how can tiny things can have a big impact in our world.

References

- https://en.wikipedia.org/wiki/MEMS
- https://en.wikipedia.org/wiki/Smart_bullet
- https://en.wikipedia.org/wiki/Precision-guided_firearm
- https://www.sandboxx.us/news/smart-bullets-the-future-of-precision-warfare/
- https://www.youtube.com/watch?v=YoOaJclkSZg
- https://www.scme-support.org/index.php/educational-materials/category-01/mems-applications-overview