

# Analog and Digital

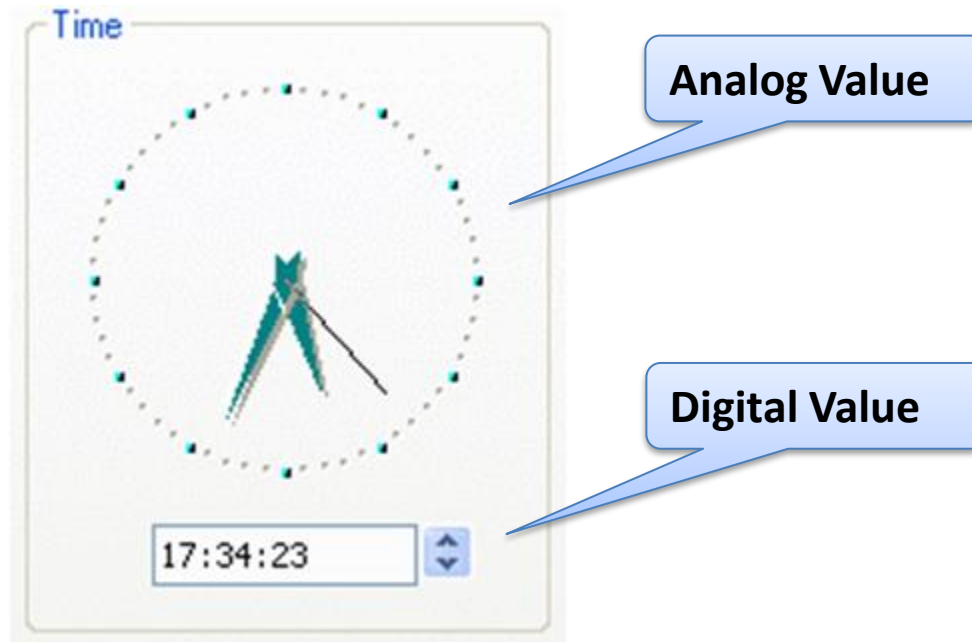
Networks and Embedded Systems

First Grade Level

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# Analog and Digital (1)

- There are analog and digital Values



# Analog and Digital (2)

- Analog Values
  - They are physical quantities
  - They have a magnitude and a unit
  - They can be measured
  - They are concrete
    - They exist in the real world
  - Their accuracy is not limited
    - A year has 365.256363004... days

# Analog and Digital (3)

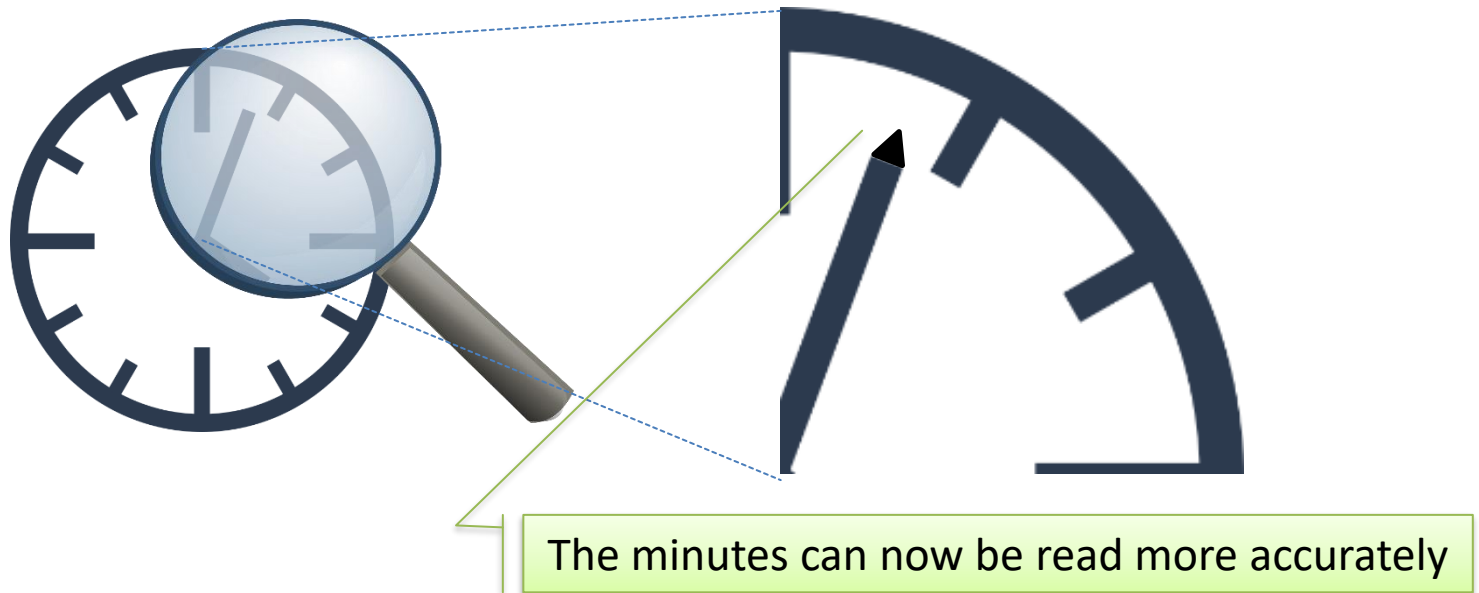
- Clock Example

- The position of the hands indicates the time
- To read the clock the angle of the hands are measured
- The unit of an angle is degree ( $^{\circ}$ ) or radian (rad)
  - But on a clock the units are hours
  - ... luckily 😊



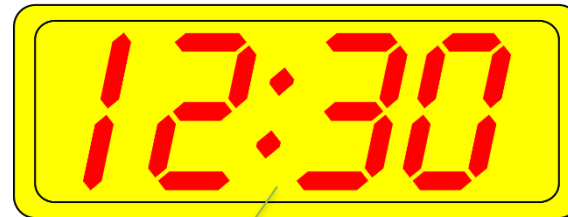
# Analog and Digital (4)

- Clock Example
  - On principle there is no limit in accuracy



# Analog and Digital (5)

- Digital Values
  - They are numbers
  - They have no unit
  - They are read
  - They are abstract
    - They are not real
    - They exist in mind, only
  - They are discrete
    - They proceed in steps



Only minutes can be read. Time proceeds in steps. The maximum accuracy is minutes.

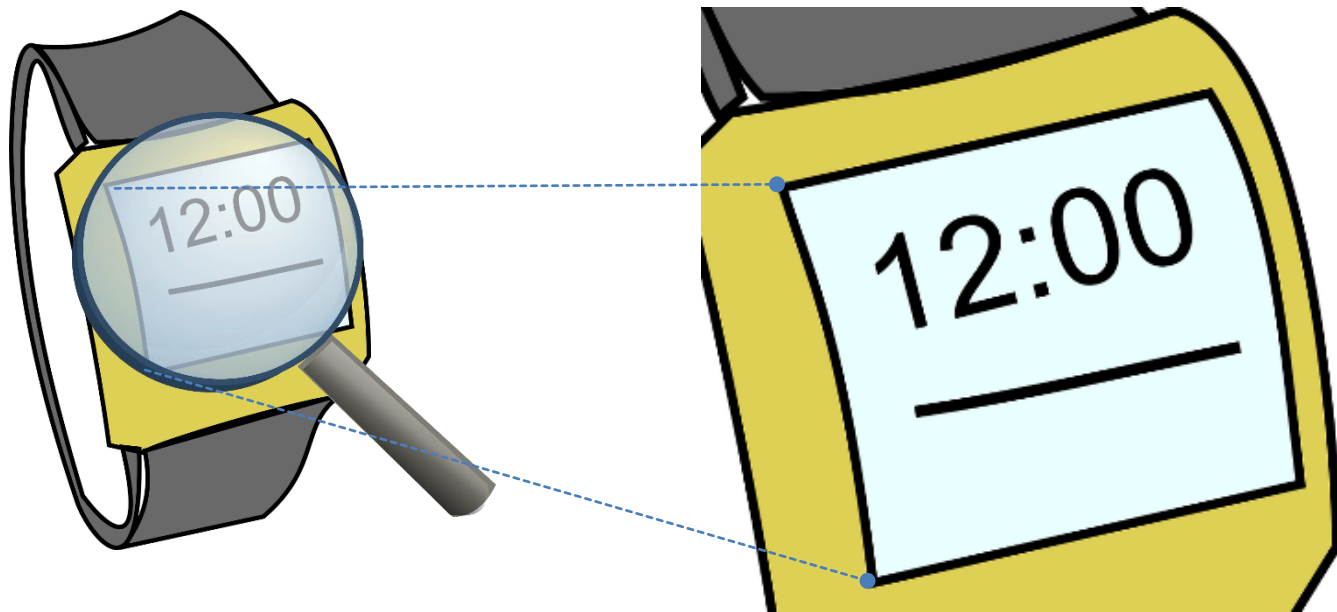
# Analog and Digital (6)

- Clock Example
  - The numbers show the time
  - They have to be read not measured
  - The units have to be known
    - The format is hh:mm
  - Only hours and minutes are shown
    - The accuracy is one minute



# Analog and Digital (7)

- Clock Example
  - The accuracy can not be increased



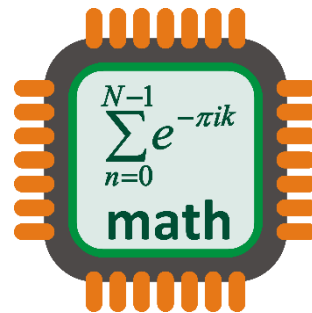
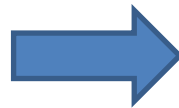


# Analog and Digital (8)

- A computer converts the value
  - A sensor detects the physical value
  - The computer calculates the number
  - The actuator displays the number



Sensor



Microprozessor



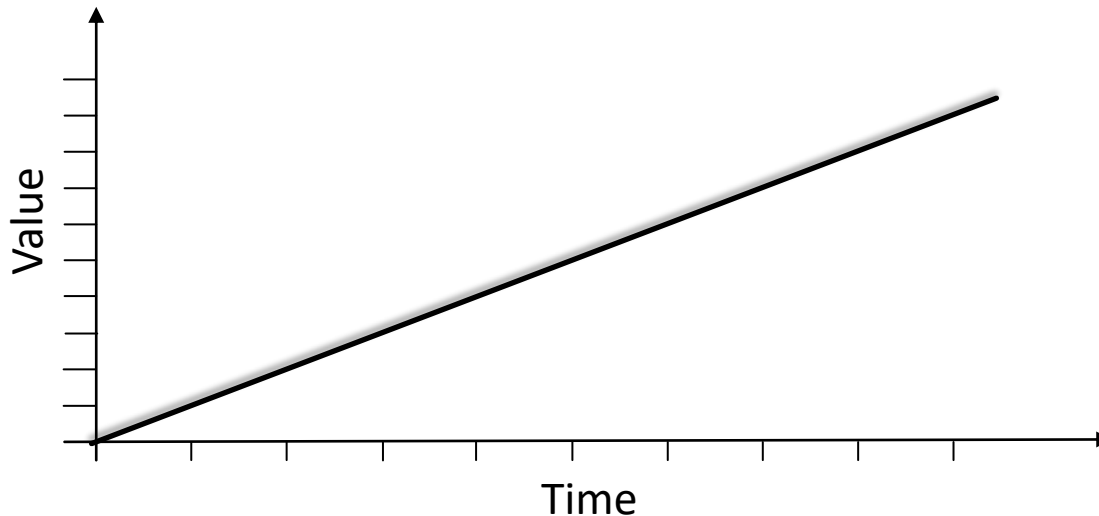
Actuator

# Analog and Digital (9)

- Digital Circuits
  - They operate on two signals
    - Plus (+) or Minus (-)
    - High or low voltage
    - One (1) or zero (0)
  - They work in a binary manner
  - How can the other numbers be represented?
    - See number systems

# Analog and Digital (10)

- Analog Signals
  - Every value is possible
  - They are continuous
  - Their curves are smooth



# Analog and Digital (11)

- Digital Signals
  - They are discrete
  - Their curves have steps

