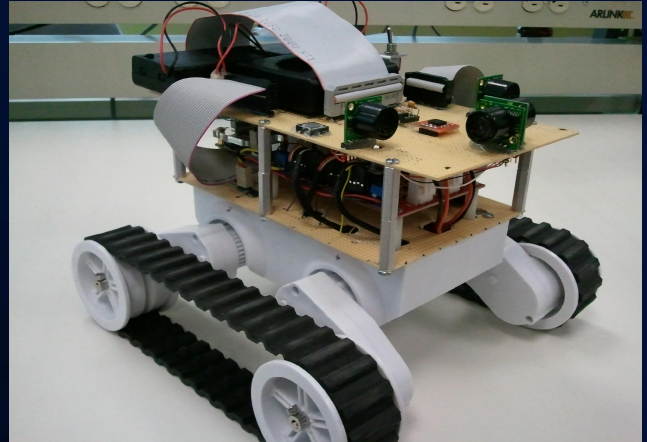# Autonomous Explorer

Group 6
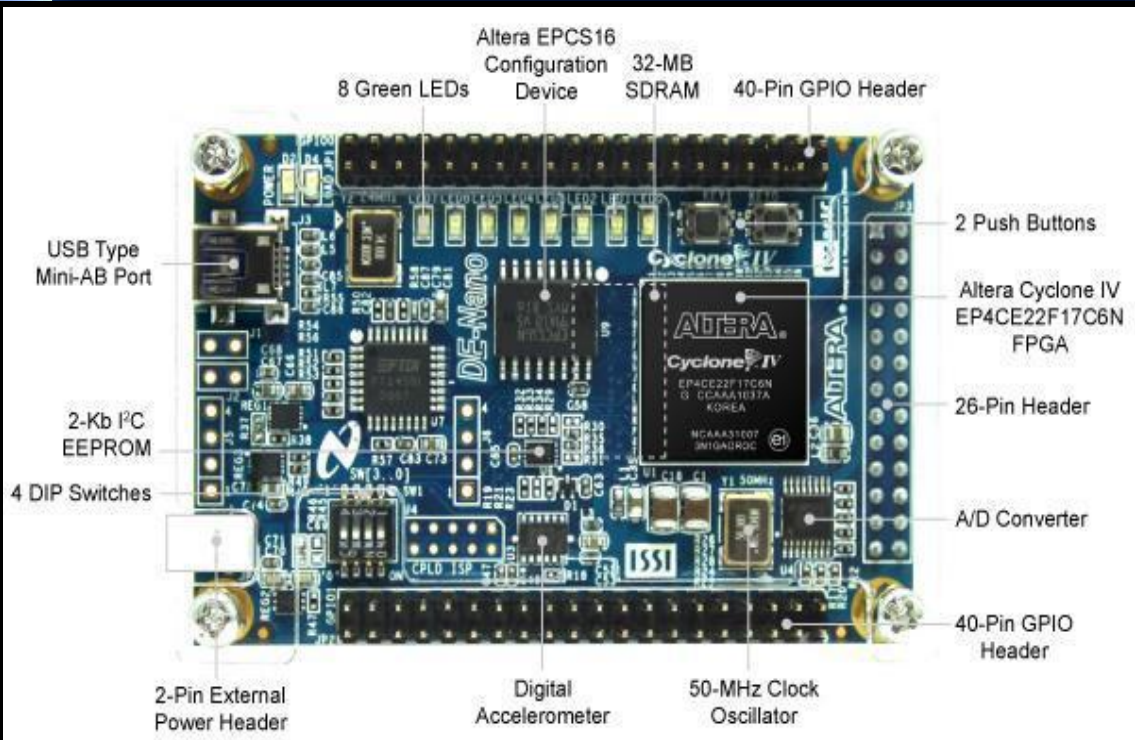Michael Jun
Braedan Jongerius
Scott Hewson

Goal

Design and build a robot that will:

- Autonomously explore its surroundings
- Avoid obstacles
- Output a 2D map of where it has been
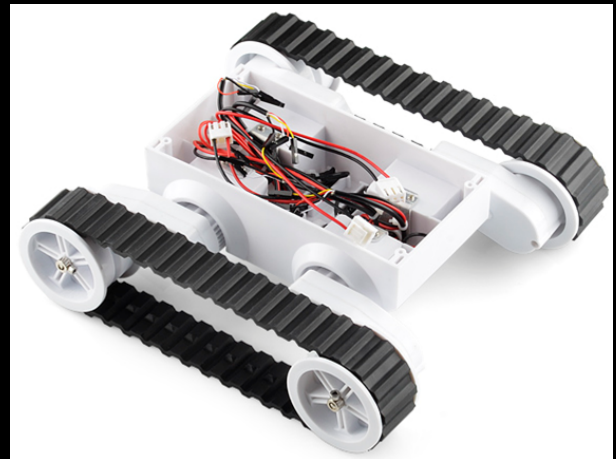
Demonstration

DE0 Nano

Source: www.altera.com/b/de0-nano-dev-board.html

Rover 5 Robot Platform

- 4 motors with an encoder each
- Adjustable ride height
- Motor rated voltage: 7.2V
- Motor stall current: 2.5A
- Torque: 10Kg/cm
- Gearbox ratio: 86.8:1
- Speed: 1Km/hr

Rover 5 Driver Board

- 4 x Low Resistance FET "H" Bridges
- Each Channel Rated for 4A Stall Current
- Easy-to-Use Control Logic
- Current Monitoring for Each Channel.
- Quadrature Encoder Mixing Circuitry
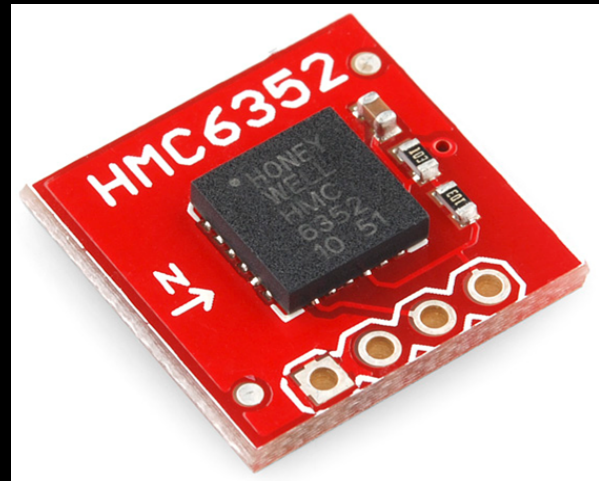
Ultrasonic Range Finder

Maxbotix EZ-LV4

- 42kHz Ultrasonic sensor
- Low 2mA supply current
- 20Hz reading rate
- Analog Output - 10mV/inch
- 6 to 254 inches (6.45m)

Source: www.sparkfun.com/products/8504
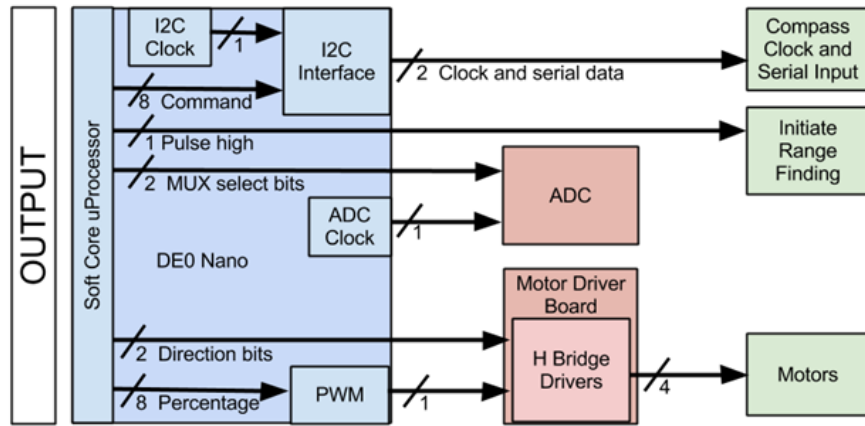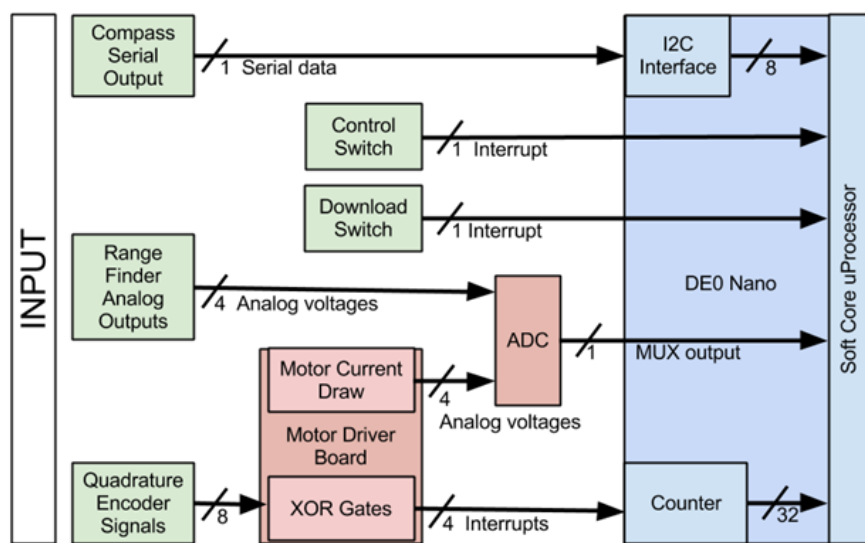
Digital Compass

Honeywell HMC6352

- Simple I^{2}C interface
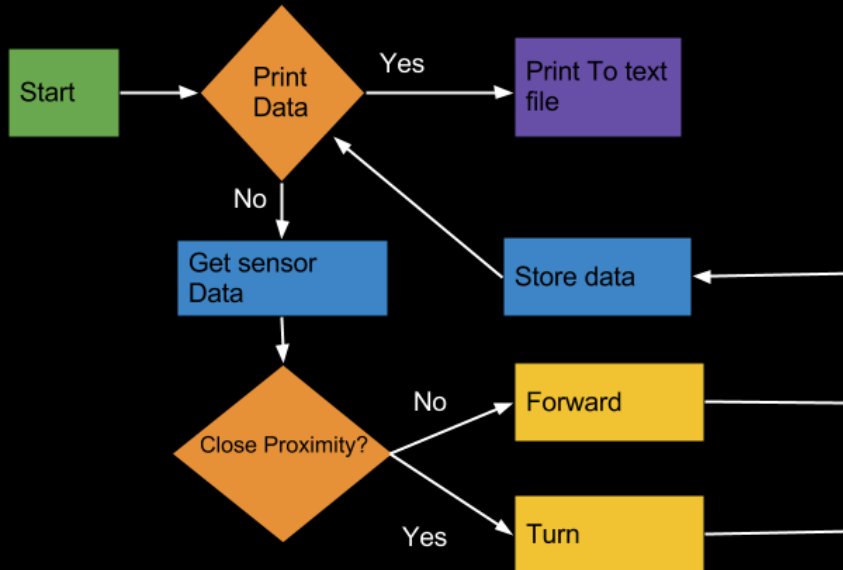- 1Hz to 20Hz selectable update rate
- 0.5 degree heading resolution

Source: www.sparkfun.com/products/7915

I/O

INPUT

Compass Serial Output → 1 Serial data → I2C Interface → 8 → Soft Core uProcessor (DE0 Nano)

Control Switch → 1 Interrupt

Download Switch → 1 Interrupt

Range Finder Analog Outputs → 4 Analog voltages → ADC → 1 MUX output

Motor Current Draw → 4 → ADC (Analog voltages)

Motor Driver Board — XOR Gates

Quadrature Encoder Signals → 8 → XOR Gates → 4 Interrupts → Counter → 32

OUTPUT

Soft Core uProcessor (DE0 Nano)

I2C Clock → 1 → I2C Interface → 2 Clock and serial data → Compass Clock and Serial Input

8 Command

1 Pulse high → Initiate Range Finding

2 MUX select bits → ADC

ADC Clock → 1 → ADC

2 Direction bits → Motor Driver Board — H Bridge Drivers

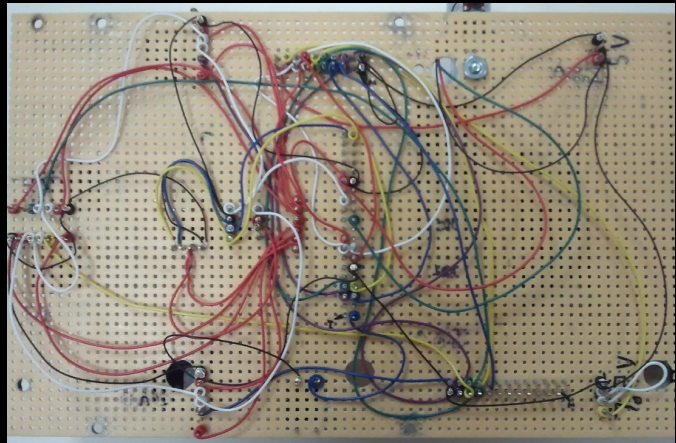8 Percentage → PWM → 1 → H Bridge Drivers → 4 → Motors

Software

Resulting Data

Challenges

- Rover isn't straight
- Range finder interference
- Compass gets interference indoors
- Lots of hardware to set up before testing

  Half of the wiring:

Future Features

- Backtrack to unexplored paths
- Output map to memory card
- Real time map streaming

Questions?