TONGUE DRIVE SYSTEM(TDS)

Project Presentation
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- ❖Hardware component description
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INTRODUCTION

- The Tongue Drive System allows handicapped users
  - move around their wheelchairs,
  - control computers or other electronic devices, and
  - manage home appliances.

- The mouth is turned into a computer using a tiny magnetic system placed on the tongue.
- The tongue is the controller and with its movement the user tells the system what to do.
- A small magnet about the size of a rice grain is attached to the user’s tongue by implantation, piercing or tissue adhesive.

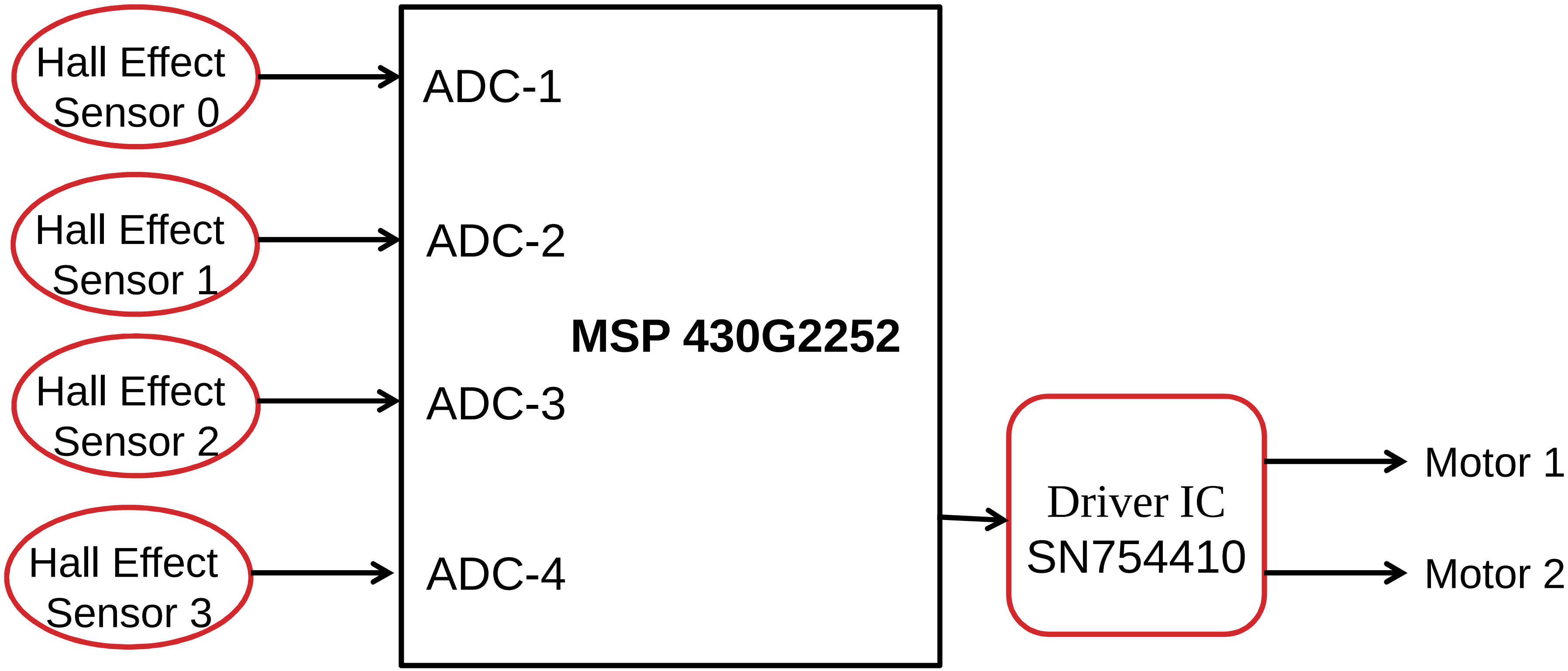
INTRODUCTION

- Movement of the magnetic tracer attached to the tongue is detected by an array of magnetic field sensors
  mounted on a headset outside the mouth.
- The sensor output signals are processed to determine the relative motion of the magnet
- This information is then
  used to control the movement of a powered wheel chair.
- To operate the Tongue Drive system, users only need to be able to move their tongues.

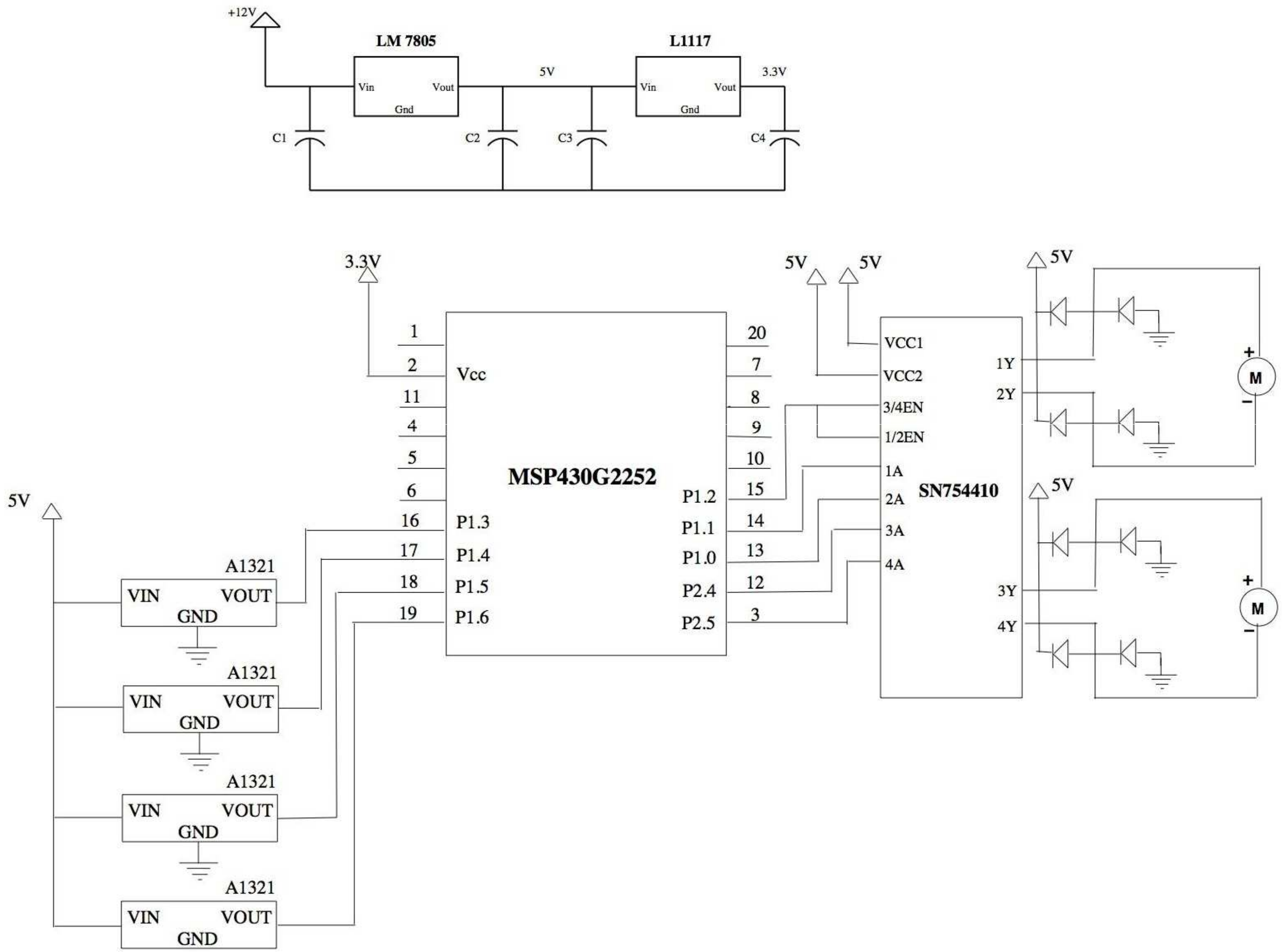
BLOCK DIAGRAM DESCRIPTION

- The hall effect sensor generates analog signal proportional to magnetic field.
- The ADC converts the analog values into digital.
- The controller configures the PWM in accordance to the software(algorithm).
- The PWM controls the speed of the motor
- The H-Bridge driver drives the motor in both directions.

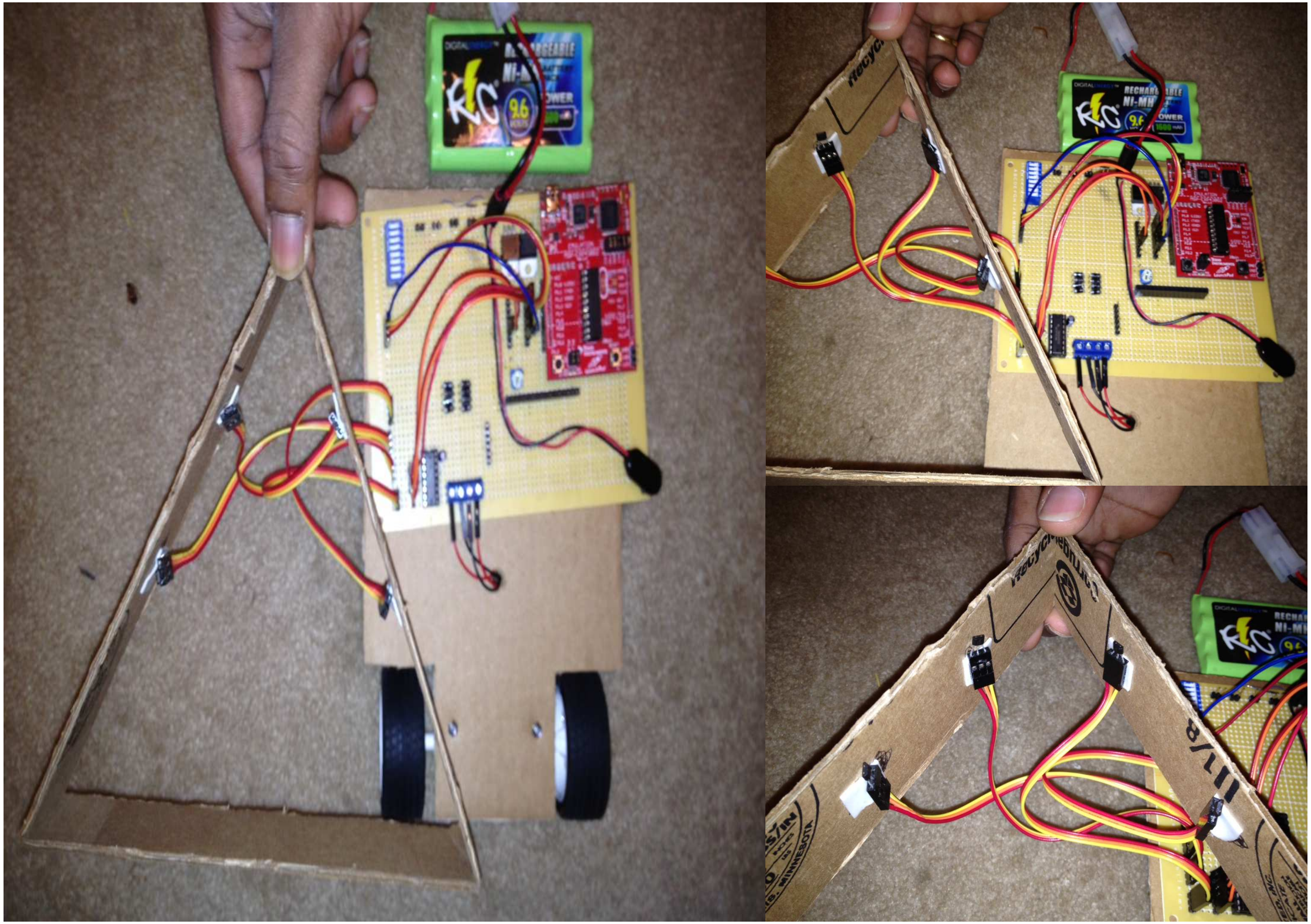
BLOCK DIAGRAM



CIRCUIT DIAGRAM

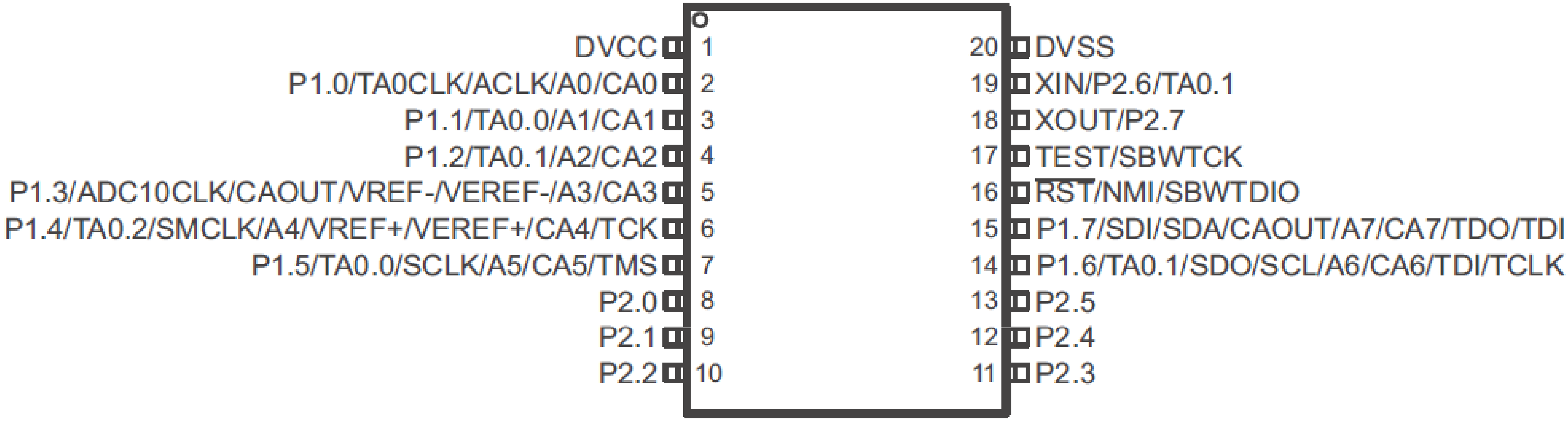


CIRCUIT DIAGRAM



HARDWARE COMPONENT DESCRIPTION

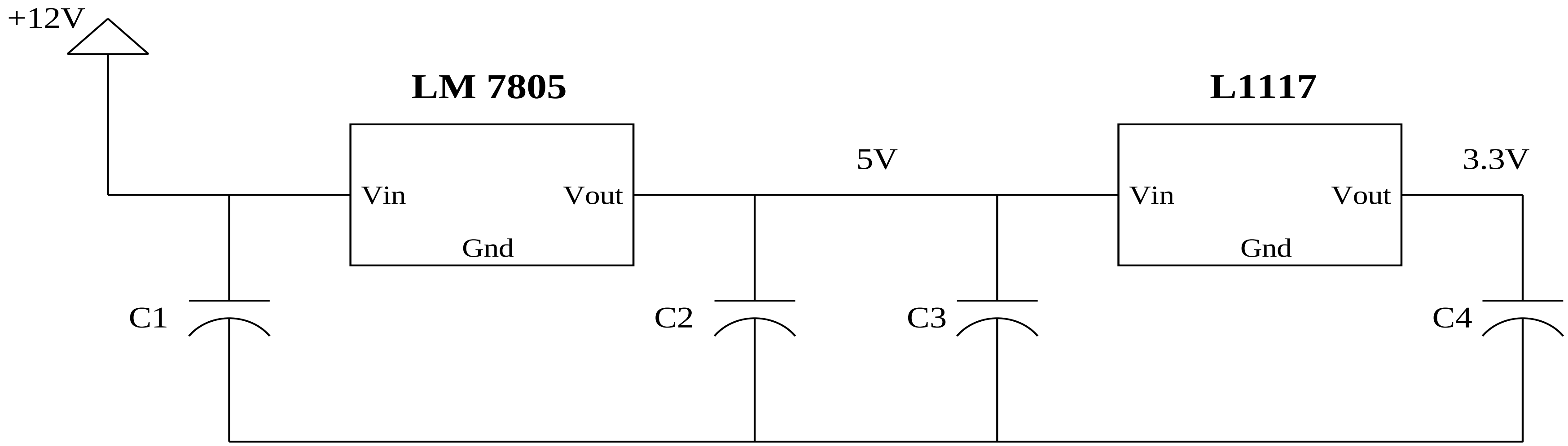
MSP430G2252



- **20-pin MSP430G2252.**
- **4 ADC Channels for taking the output from the hall effect sensor**
- **5 pins as input to the H-bridge driver.**

HARDWARE COMPONENT DESCRIPTION

Power Supply



- Two regulators LM 7805 and L1117 are used.
- The hall effect sensors and the H-bridge driver require 5V.
- MSP430 controller requires 3.3V.
- The motors run on 5V.

HARDWARE COMPONENT DESCRIPTION

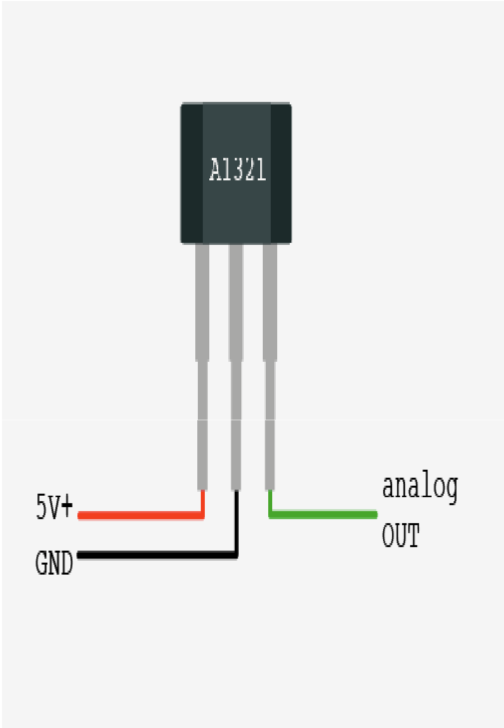
Hall Effect Sensor - A1321

- Hall-effect sensors provide a voltage output that is proportional to the applied magnetic field.

- A1321 is a linear Hall Effect Sensor which is sensitive and temperature stable.

- They are ideal for use in the harsh environments.

- It is connected to the ADC input channel of the MSP430G2252.



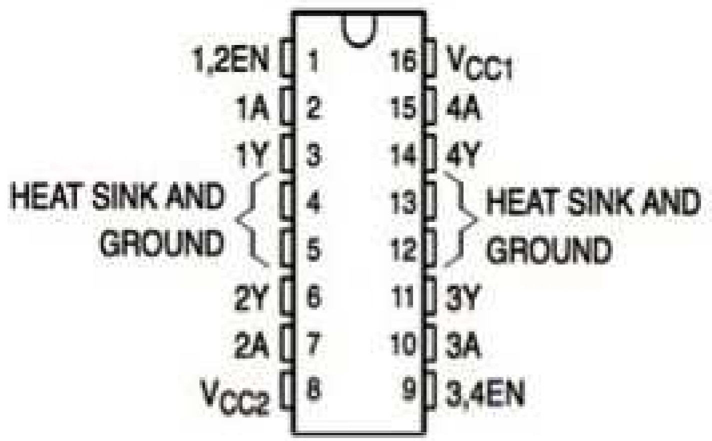
HARDWARE COMPONENT DESCRIPTION

H-Bridge Driver - SN754410

- **SN754410 is a bidirectional driver and it can drive two motors at a time.**

- **Capable of driving high voltage motors**

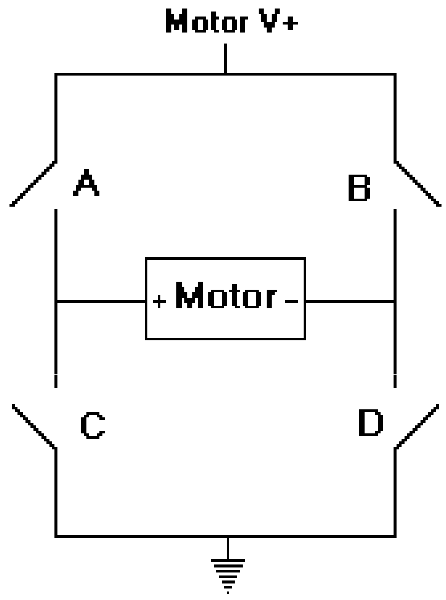
- **It is controlled by the Pulse Width Modulated (PWM) signal. PWM is generated using timers on port 1.2.**



HARDWARE COMPONENT DESCRIPTION

H-Bridge Driver - SN754410

- **An H bridge is built with four switches.**
- **When the switches A and D are closed (and B and C are open) a positive voltage will be applied across the motor.**
- **By opening A and D switches and closing B and C switches, this voltage is reversed, allowing reverse operation of the motor.**



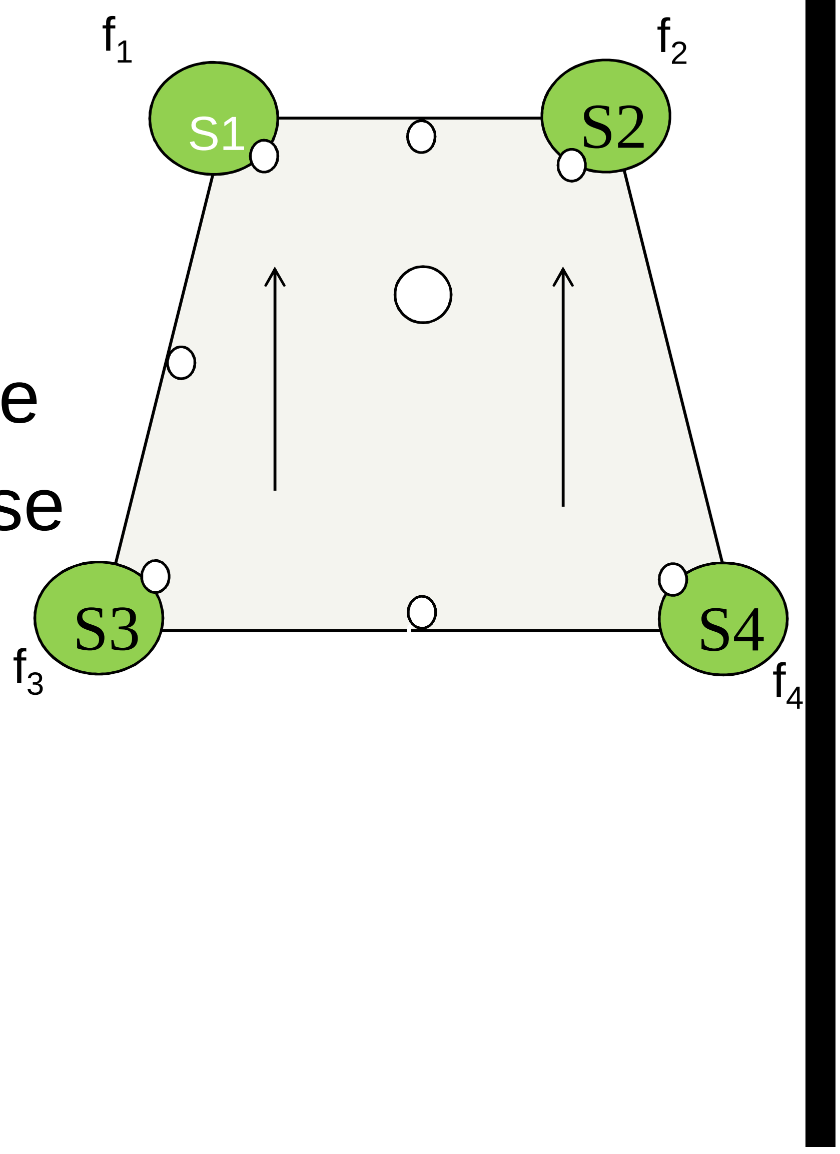
Algorithm

f_1 - $S_1 > 750$ // forward

f_2 - $S_3 > 600$ // backward

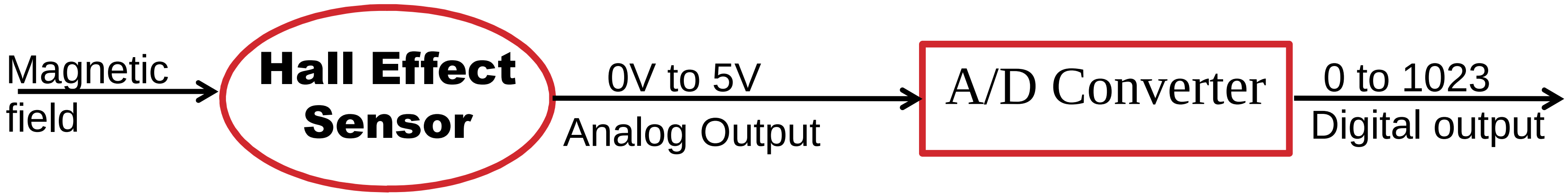
f_3 - $S_3 > 700$ // speed increase

f_4 - $S_4 > 700$ // speed decrease



SOFTWARE DESCRIPTION

Analog to Digital Converter(ADC)



Analog Voltage from Sensor(V)	Corresponding Digital Value
0	0
2.5	512
5	1023

SOFTWARE DESCRIPTION

Analog to Digital Converter(ADC)

- A 10-bit ADC is used to convert the analog output from the sensor to a digital value.
- 4 ADC channels: A3, A4, A5, A6 on pins P1.3- P1.6.

ADC Configuration:

- The conversion is initiated using the ADC10SC bit.
- A Single channel Single conversion mode is used.
- ADC10 oscillator is used as input clock to the ADC.
- The sampling time chosen is 16 times the ADC10 clock.

SOFTWARE DESCRIPTION

Pulse Width Modulator(PWM)

- **A modulating technique which generates variable width pulses is used to vary the speed of the motor.**
- **The Duty cycle is varied based on the input values at P1.5 and P1.6 from sensors 3 & 4 respectively.**
- **The output is driven from P1.2 of controller to the 1,9 enable pins of H-bridge.**

PWM approach:

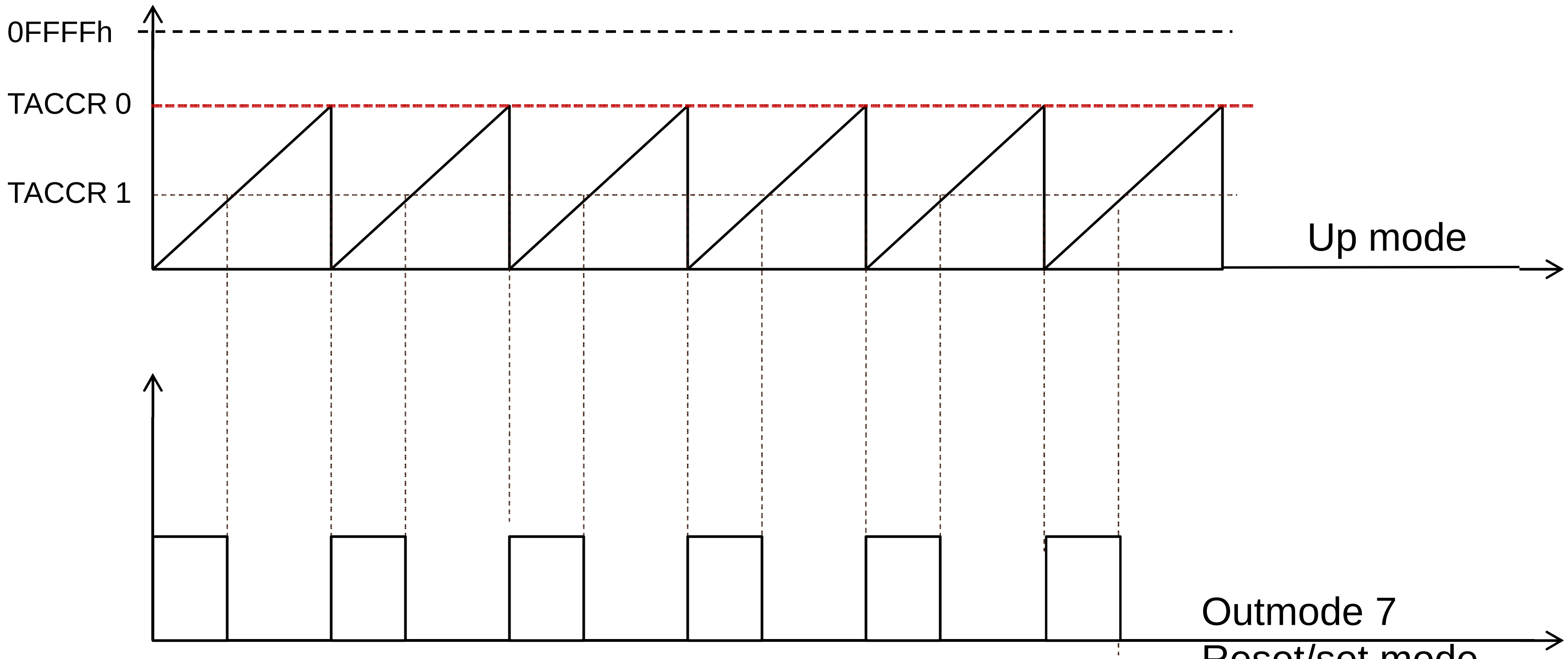
- **We set the corresponding modes**
- **Timer operating mode is UP mode (mode 1).**
- **Output mode is reset/set mode (mode 7).**

SOFTWARE DESCRIPTION

Pulse Width Modulator(PWM)

- **Of the 9 16bit registers, 2 CCR registers, TAR register the corresponding control registers are used.**
- **Initially, TACCR0 and TACCR1 are initialized to certain value. TACCR1 is incremented or decremented by a value based on the outputs from sensors 3 and 4 respectively.**
- **Thus as the Duty cycle is varied the output power is varied and the output is fed to enable pins of H-bridge to change the speed.**

SOFTWARE DESCRIPTION



Duty Cycle = (TACCR1/ TACCR0) *100

CHALLENGES

- **Back E.M.F produced by motors.**
- **ADC value was read before completion of conversion.**
- **Exact Positioning of sensors.**
- **Turning the vehicle Left or Right.**

CONCLUSION & FUTURE WORK

This device could revolutionize the field of assistive technologies by helping individuals with severe disabilities such as those with high-level spinal cord injuries return to rich, active, independent and productive lives.

Wireless communication.
More sensor, Better navigation.

QUESTIONS?