A Project using TI MSP430

“TOUCH TO SING “

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CHAPTER 1
INTRODUCTION

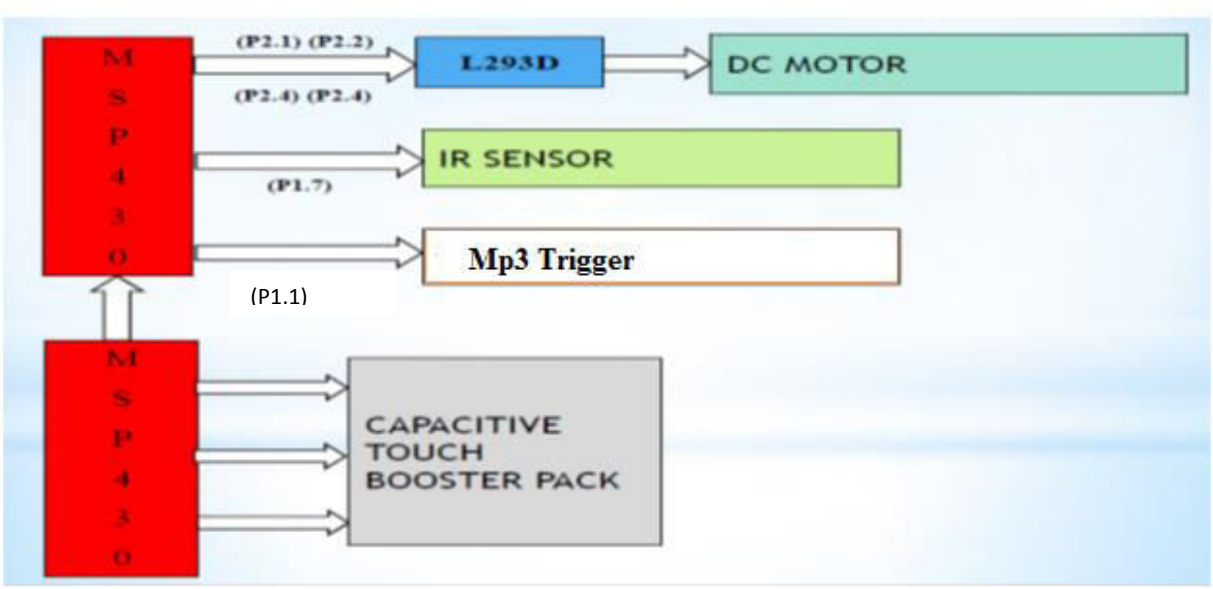
Abstract: With the topic of a toy in mind, we thought of designing this toy that basically sings when touched. The toy is usually in locomotion, moving when a switch is turned on using motors, until it encounters an obstacle, which is detected by an on board IR sensor. On encountering an obstacle, the LED'S on board the chassis glow vibrantly, which naturally attracts the child towards it. On board we have used a touchpad/ proximity sensor that senses the child coming towards it. Once the child is in the range of the sensor, the Mp3 trigger is activated and starts playing the files stored on the Micro SD Card. We have introduced a delay loop here, that basically has a count equal to the length of the audio file. Once this delay reaches zero, it is assumed that the song has ended and the motor is started again. The toy then moves in the reverse direction for some time, then takes a right and keeps moving until it encounters another obstacle.

Motivation: With the growing IQ of children, they are in need of intelligent toys, which not only help them in their physical growth but also instill in them a sense of curiosity. We have formulated our project around this idea. When the child sees the LED glowing it is naturally attracted towards it but this also makes it think as to why the LED changes color. Also it is scientifically proven that music can be soothing to the ears, which will make the child divert its attention towards the toy, thereby reducing some burden on the parents.

CHAPTER 2
HARDWARE COMPONENTS & BLOCK DIAGRAM

2.1 BLOCK DIAGRAM

It consists of two msp430 microcontroller as shown in the block diagram. One is exclusive for touchpad and other MSP for IR sensor, motor driver (dual H bridge) which is in turn connected to geared dc motor and last one to MP3 trigger.



2.2 INFRARED SENSOR (Sharp GP2Y0A02YK0F):

It is composed of an integrated combination of PSD (position sensitive detector) , IRED (infrared emitting diode) and signal processing circuit. This device outputs the voltage corresponding to the object distance. So this sensor can also be used as a proximity sensor. Some specification of sensors are.

1. Distance measuring range : 20 to 150 cm
2. Analog output type
3. Package size : 29.5×13×21.6 mm
4. Consumption current : Typ. 33 mA
5. Supply voltage : 4.5 to 5.5 V

Varying output voltage is sensed by ADC of microcontroller for further calibration.

Resolution of ADC = $\frac{Vref}{2^n-1}$.....where Vref= 3 Volts and n=number of bits i.e 10-bit.

$=\frac{3}{2^{10}-1}$

=2.9 mv

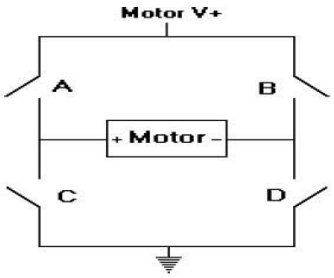
This means that it will map input voltages between 0 and ~3 volts (VCC) into integer values between 0 and 1023

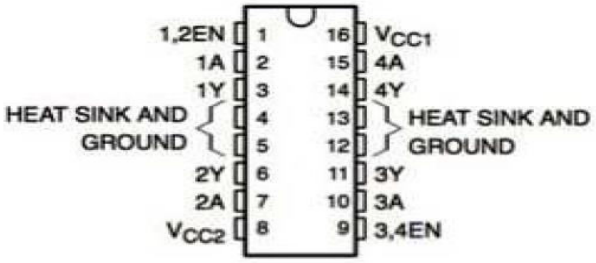
The IR sensor has 3 pins i.e. Vcc, Ground and Output which is connected to Vcc, ground and one input pin respectively on the msp430 microcontroller.

This is the IR sensor that we have used in our project.

2.3 H-Bridge Driver

The H-bridge driver is used to drive the wheels of the vehicle. SN7454410 is the driver that we have used in out project. This driver can deliver a maximum current of 1Amp and Voltage of around 36V. This driver can be used for driving high voltage devices. 5 V power supply is given to this driver. The speed of the vehicle can be controlled by the PWM signals from msp430 given to the enable pins of L293D.





The pins of driver IC 1, 9 are connected to the PWM channel of the msp430, VCC1 is the power supply to the IC VCC2 is the power supply for driven vehicle. A pins are connected to the microcontroller and y pins are connected to the DC motors or the device which is to be driven. 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

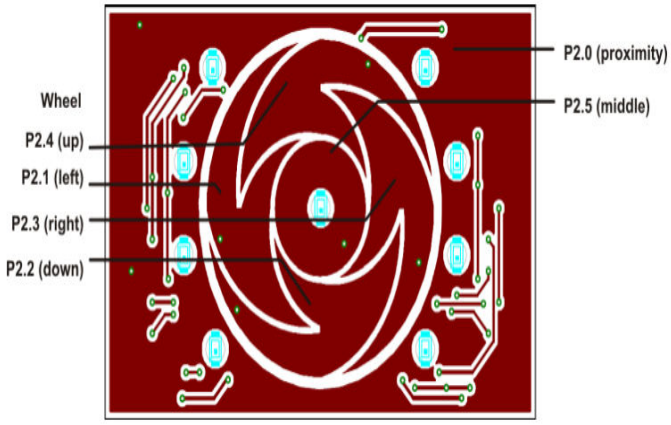
2.4 GEARED DC MOTOR

We have used a 5V 40 rpm DC motors with a for driving the vehicle. We used 2 motors one for left and one for right so that turning might be made easy, left motor at rest and right motor in motion turns vehicle left and vice versa, for forward and backward motion both the motors are driven in same direction with same speed.

This is the gearbox we have used for driving our vehicle. The dc motors in this gearbox can be driven by 5V supply.

2.5 MSP430 Capacitive Touch BoosterPack

The Capacitive Touch BoosterPack (430BOOST-SENSE1) is a plug in board for the MSP430 Value Line LaunchPad development kit (MSP-EXP430G2). This BoosterPack features several capacitive touch elements including a scroll wheel, button and proximity sensor. Also, on- board are 9 LEDs that provide instant feedback as users interact with the capacitive touch elements. When paired with the LaunchPad kit, the Capacitive Touch BoosterPack provides a complete hardware and software reference design to enable developers to quickly and easily replace any physical button with a capacitive touch element.



This is the touchpad used in our project.

To prepare the Capacitive Touch BoosterPack hardware for its first use:

1. Solder both 10-pin male headers onto the LaunchPad's breakout pin connections J1 and J2. These two 10-pin male headers and two 10-pin female headers come with the original LaunchPad kit.

2. Remove the J5 connections on the LaunchPad to disconnect the LaunchPad LEDs and keep them from interfering with P1.0 and P1.6 functions of the Capacitive Touch BoosterPack.

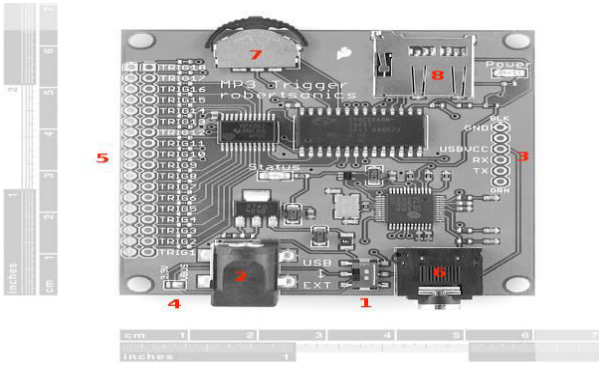
3. Ensure jumpers VCC, TXD, and RXD of the J3 connection are populated for the user experience demo to operate properly.

4. Replace the existing MSP430 device in the LaunchPad MCU socket with the MSP430G2452 device that comes with the Capacitive Touch BoosterPack kit.

5. Connect the Capacitive Touch BoosterPack board to the LaunchPad with proper orientation by ensuring that the Texas Instruments logo and the text on the BoosterPack are in the same direction as the text and logo on the Launchpad.

6. Connect the LaunchPad with an USB cable to a PC or connect an external power supply (2.7 V to 3.6 V) to J6. The user experience demo application lights the center LED when power is supplied to the board.

2.6 Mp3 Trigger Circuit



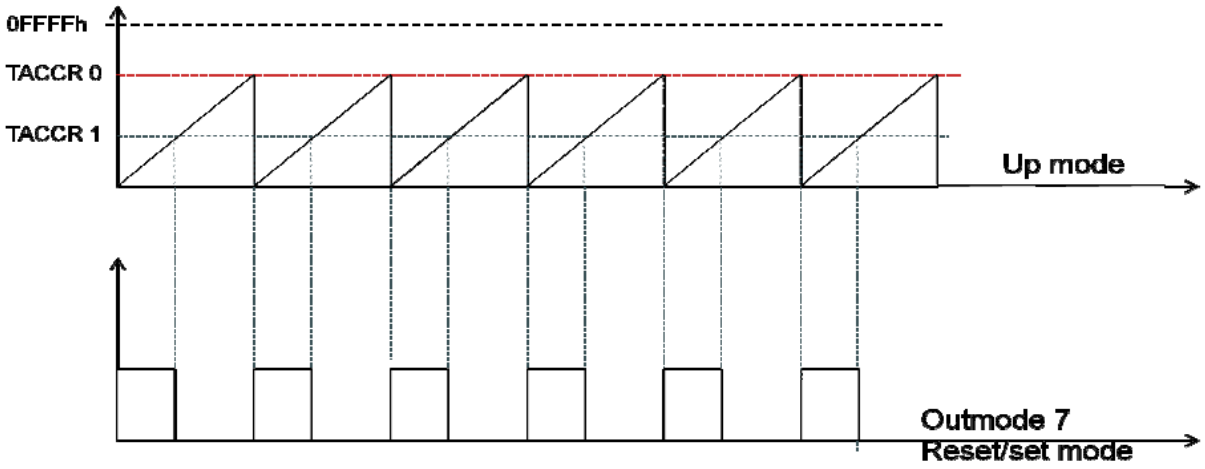
The Sparkfun Mp3 trigger is a low cost, active low device that contains a Cypress Semiconductors decoding chip that basically does the decoding of the audio file at a certain baud rate that is set by the user or a default baud rate. The device has a 3.5mm jack that outputs the read audio file. The device has 18 trigger inputs that can play up to 512 tracks from the Micro SD card. The device can be powered up either by giving 3.3V via USB or 5V external supply. The device contains a push button that can be used to change the tracks or stop them. The device also has UART ports to receive data which trigger the circuit. The RX and TX pins are used for this purpose. The device also allows the user to write an initialization file that allows the user to repeat a track and set the volume and also set a Playlist.

CHAPTER 3

SOFTWARE CONFIGURATION

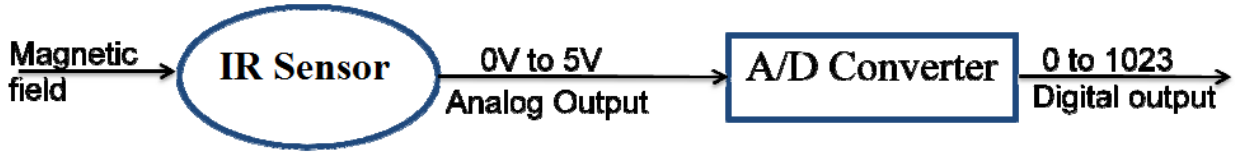
3.1 PWM (Pulse Width Modulation)

PWM is one of the complex module of our project, we have been struggling for a longer time in achieving PWM signals. A modulating technique which generates variable width pulses is The Duty cycle is varied based on the input values at P1.5 and P1.6 from sensors 3 & 4 respectively. driven from P1.2 of controller to the 1,9 enable pins of H Bridge changing values in the TACCR1 register in msp430 program.



3.2 ADC10 (Analog to Digital converter)

MSP430g2553 has 8 ADC channels of 10bit each, this ADC10 of the msp430 is used to convert the analog signals from the hall effect sensor into digital value. ADC10 is of 10bits hence we can get the value ranging from 0- 1023 depending on the value of voltage supplied to the ADC pin. P1.7 on the msp430 is used.



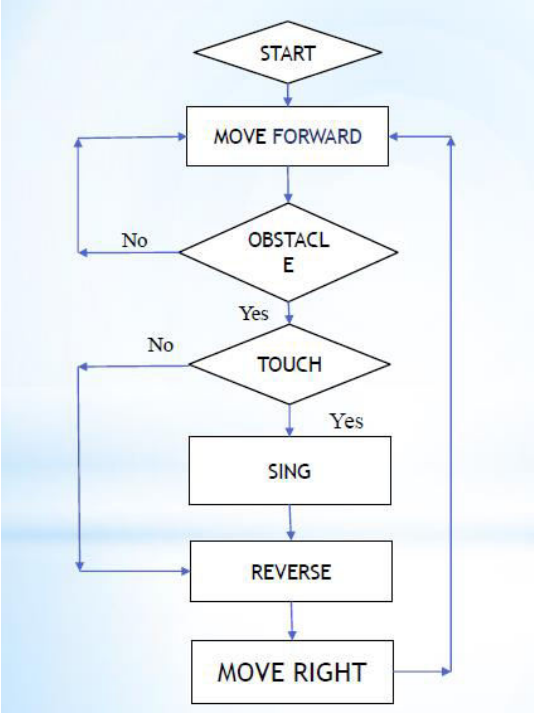
3.3 CONFIGURING THE SOFTWARE LIBRARY

The Capacitive Touch Software Library must be configured with the port definition, sensing method, number of elements, and other factors. These factors can be configured in structure.c source code and structure.h header files. The following steps are presented using the RO_PINOSC_TA0_WDTp_Wheel_Button Example where the sensing method is RO_PINOSC_TA0_WDTp and the sensor structure comprises of one button (the middle element).

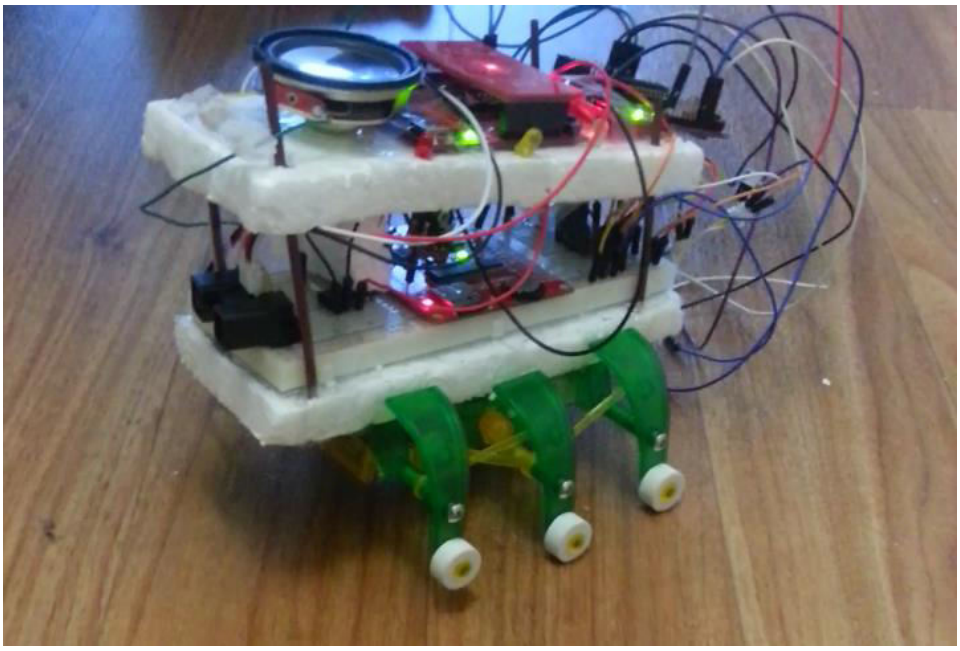
3.4 TRIGGERING THE MP3 CIRCUIT

When the capacitive booster pack is touched, certain pins on the MSP430 are set high. We use this high from the pin to trigger the Mp3 device, there by synchronizing the components. This is done by using UART on the MSP430. The MP3 trigger circuit is connected to P1.1 on the MSP and the required character is sent using UART upon which the device gets triggered and the audio file is played.

3.5 ALGORITHM



RESULT



APPENDIX

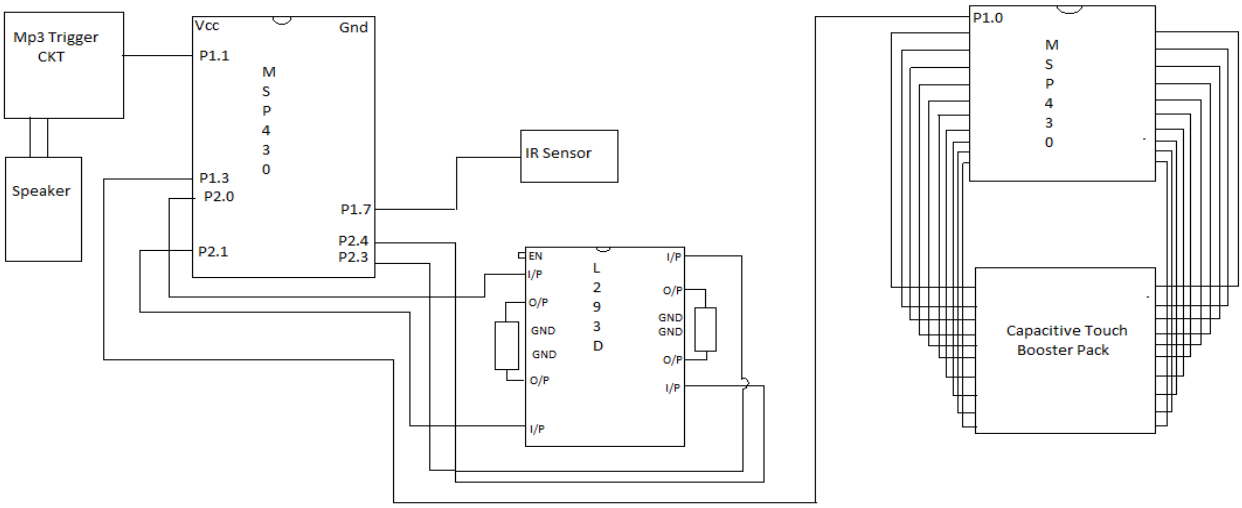
TASK DIVISION

1. **Aniruddha Harish –** MP3 Triggering Using UART and Touchpad Synchronizing
2. **Ankit Gala** - Enabling the Touchpad Using Capacitive Library
3. **Jaswant Katragadda** - Determing the Range of Sensor
4. **Prashanth Prakash** - Controlling the Motor using PWM and Interfacing with the Sensor
5. **Common –** Hardware Interfacing

BILL OF MATERIALS

1. MP3 Trigger	$49
2. Capacitive Touchpad Boosterpack	$10
3. Two MSP430	$14
4. IR Sensor	$8
5. H-Bridge	$2.5
6. Bumper Bug	$40
7. Jumper Wires	$2
8. Bread Board	$5

SCHEMATIC


Mp3 Trigger CKT
Speaker
Vcc
Gnd
P1.1
MSP430
P1.3
P2.0
P2.1
P1.7
P2.4
P2.3
IR Sensor
EN
I/P
O/P
GND
GND
O/P
I/P
L293D
I/P
O/P
GND
GND
O/P
I/P
P1.0
MSP430
Capacitive Touch Booster Pack