HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY
FACULTY OF TRANSPORTATION ENGINEERING
Department Automotive and Engine

Project: DESIGN OF M.EXPANDER CRANKSHAFT AND CAMSHAFT POSITION SENSOR SIMULATOR

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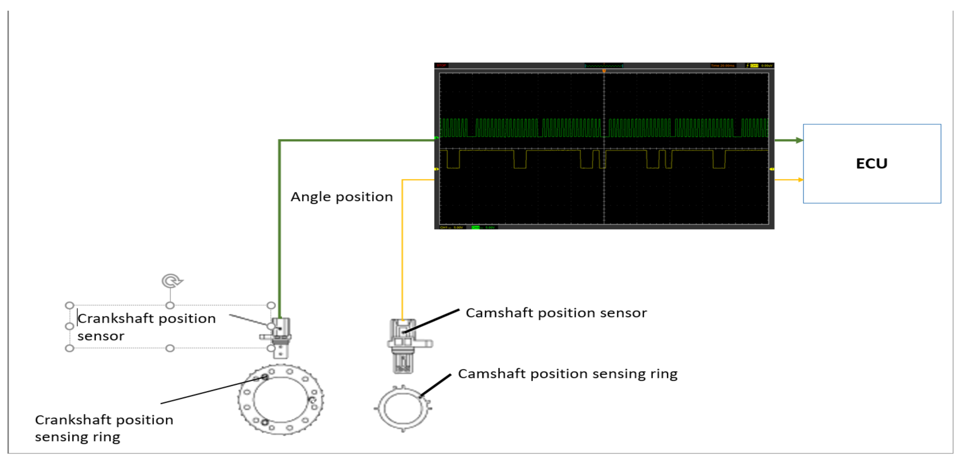
I. INTRODUCTION

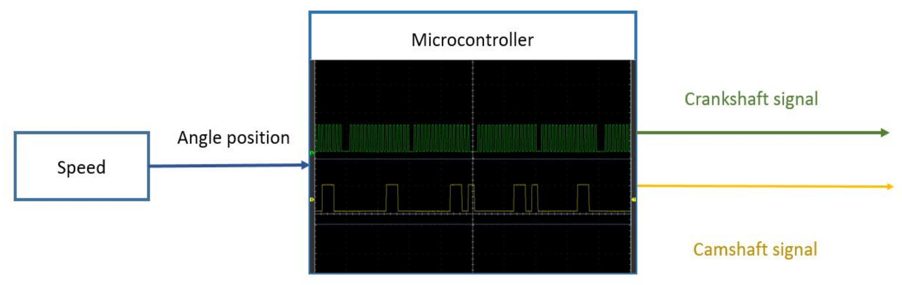
1.1 Working principle

- The crank angle sensor monitors rotation of crankshaft sensing ring (36 teeth including 3 missing teeth) installed on the crankshaft and converts to voltage (pulse signal) that is output to engine-ECU. Engine-ECU uses crank angle sensor's output pulse to detect crank angle.

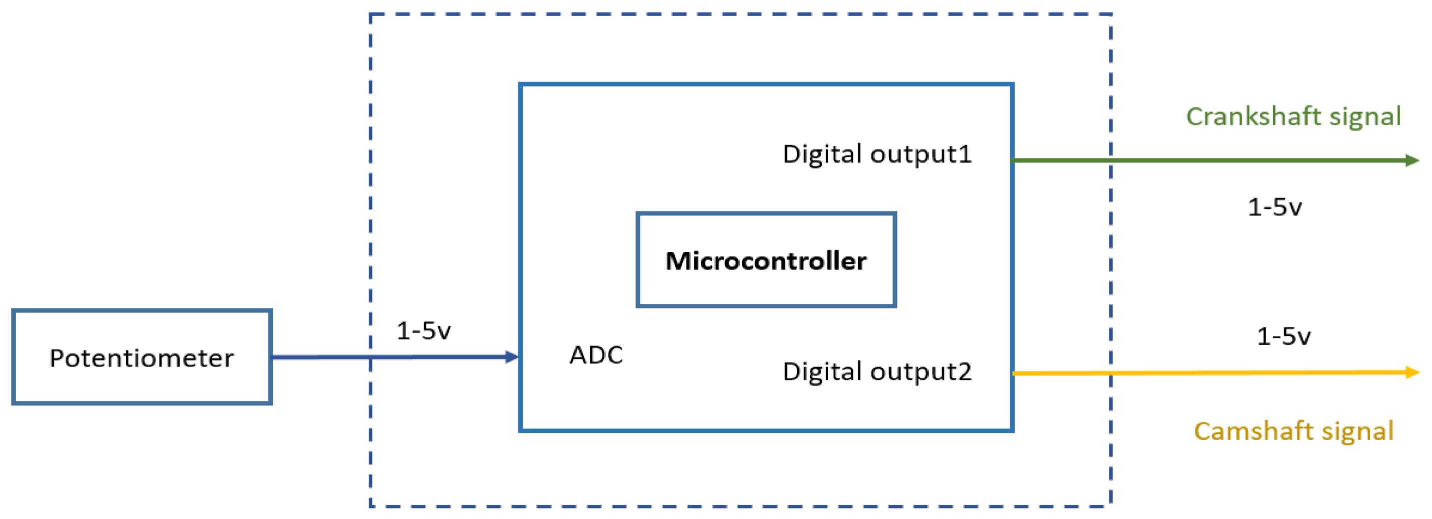
- The camshaft position sensor monitors rotation of the camshaft position sensing ring (6 teeth) and converts to voltage (pulse signal) that is output to engine-ECU. Upon receiving this output voltage, the engine-ECU effects feedback control to optimize the phase of the camshaft. Engine-ECU uses a combination of the camshaft position sensor output pulse signal and crank angle sensor output pulse signal to identify cylinders in the compression process. This information will help to fine tune spark timing and injector pulse.



1.2 Mitsubishi Expander crankshaft and camshaft signal simulator

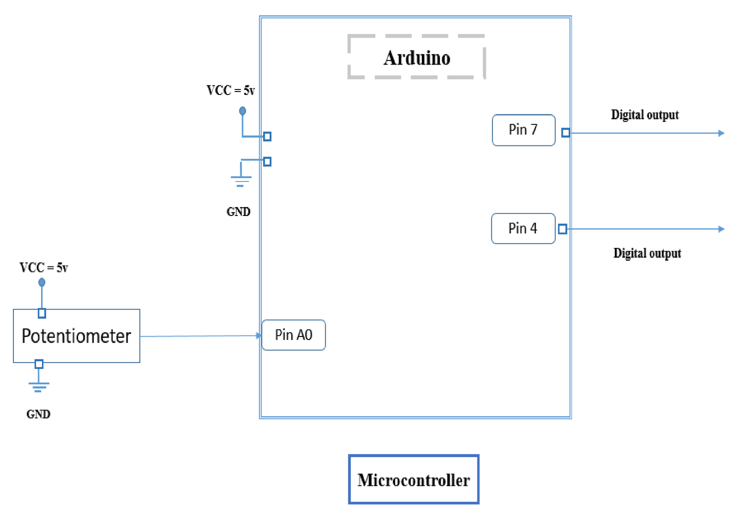


II. GENERAL LAYOUT DESIGN

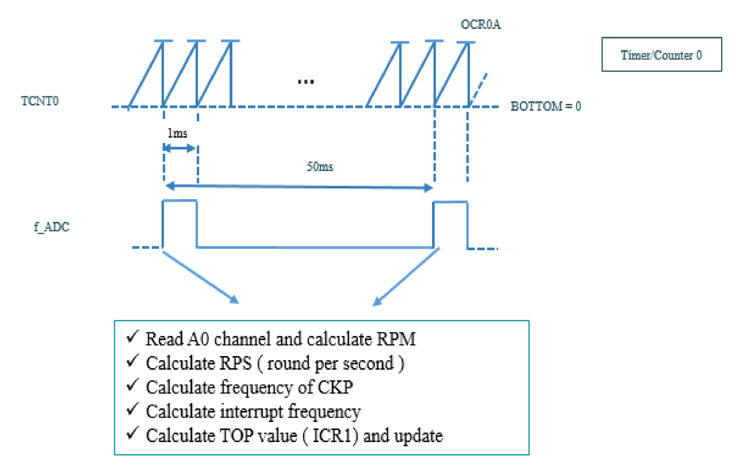


III. TECHNICAL DESIGN

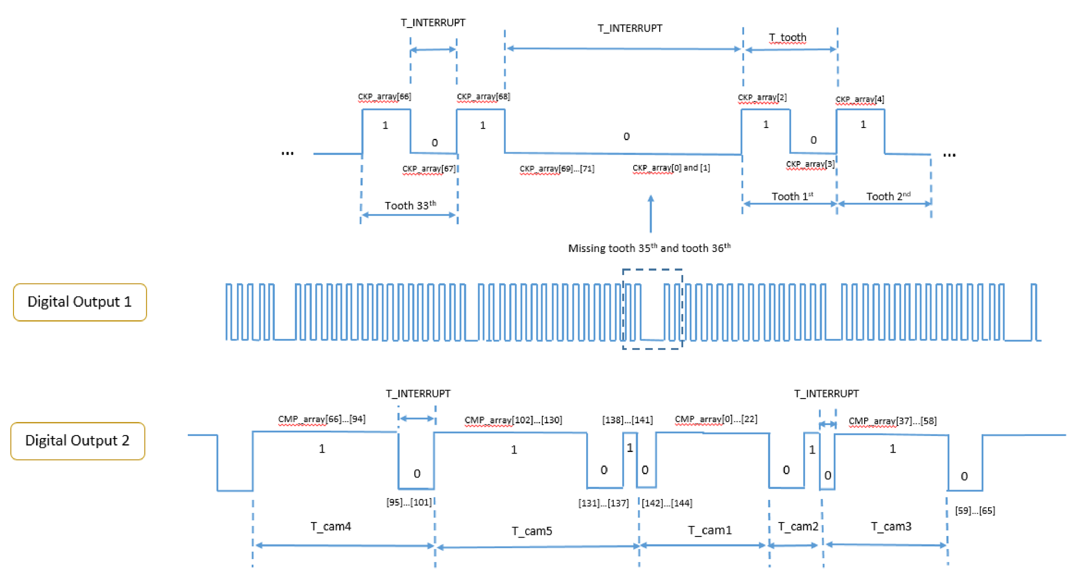
Electrical scheme



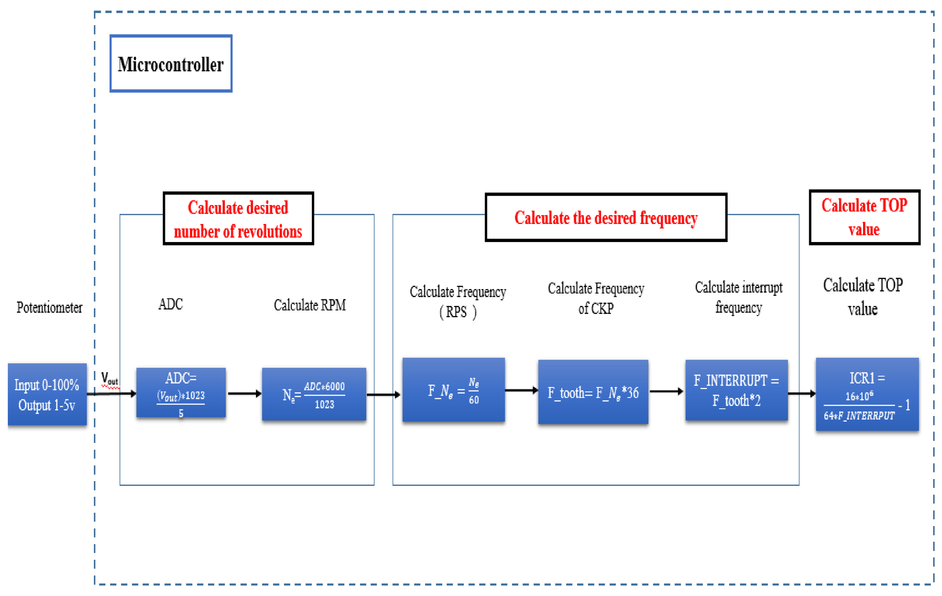
Timing diagram of timer 0



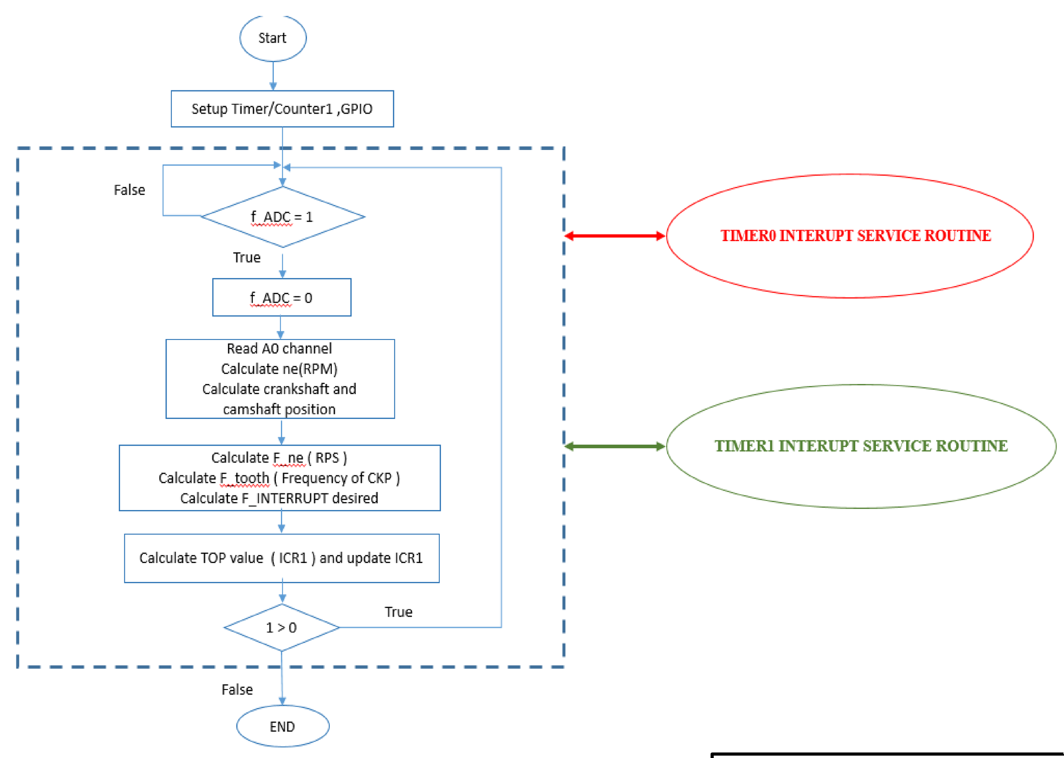
Timing diagram of timer 1



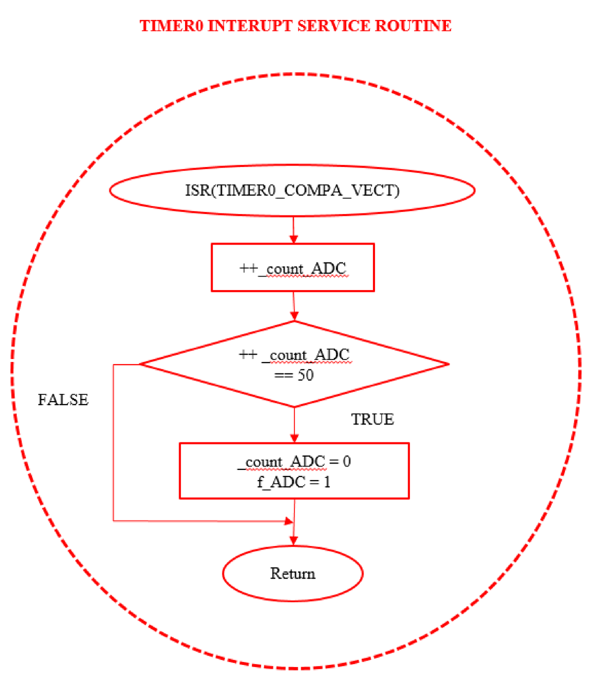
Frequency diagram



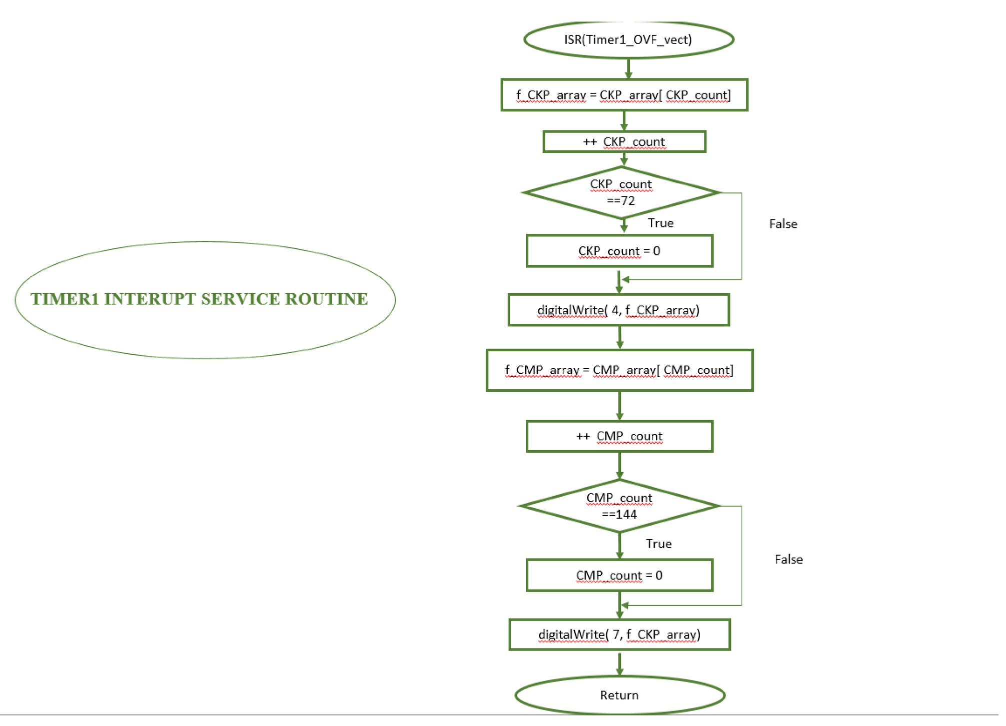
Algorithm of main program



Algorithm of Timer 0

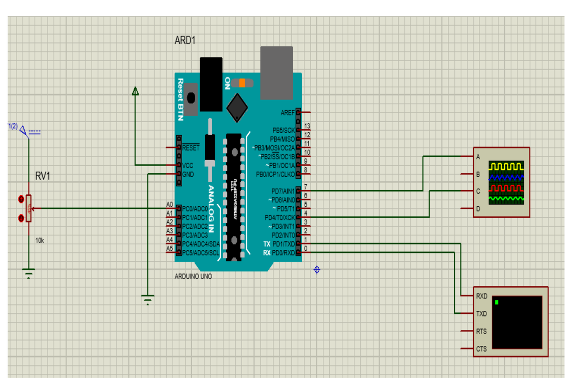


Algorithm of Timer 1

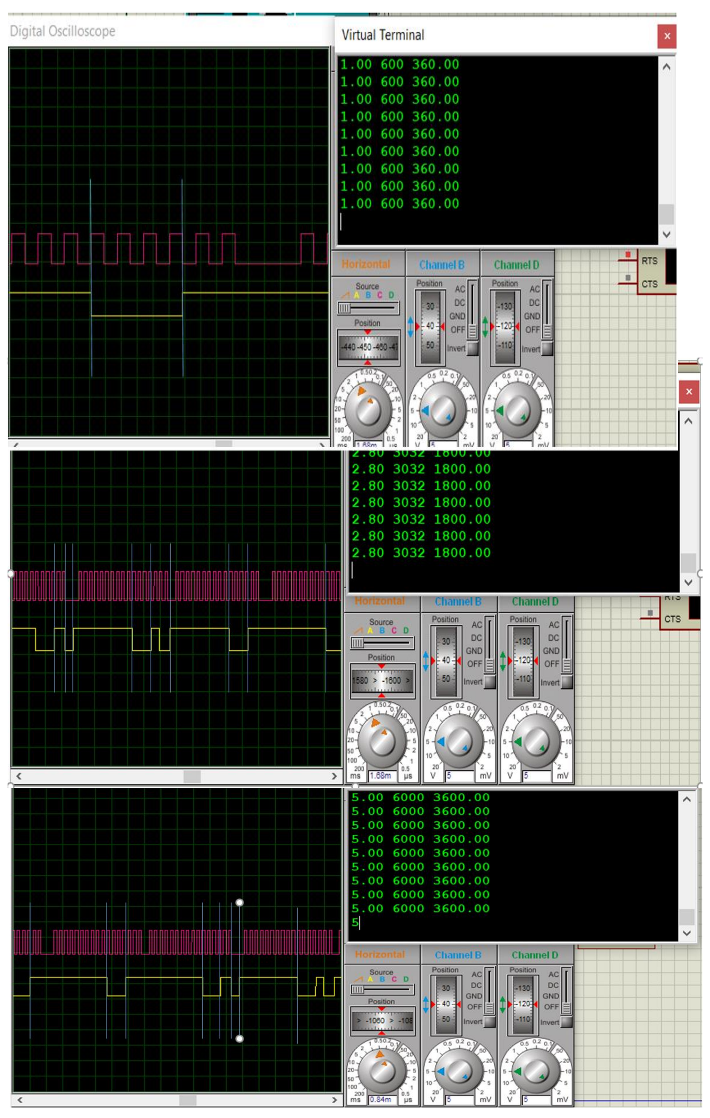


IV. SIMULATION AND RESULT

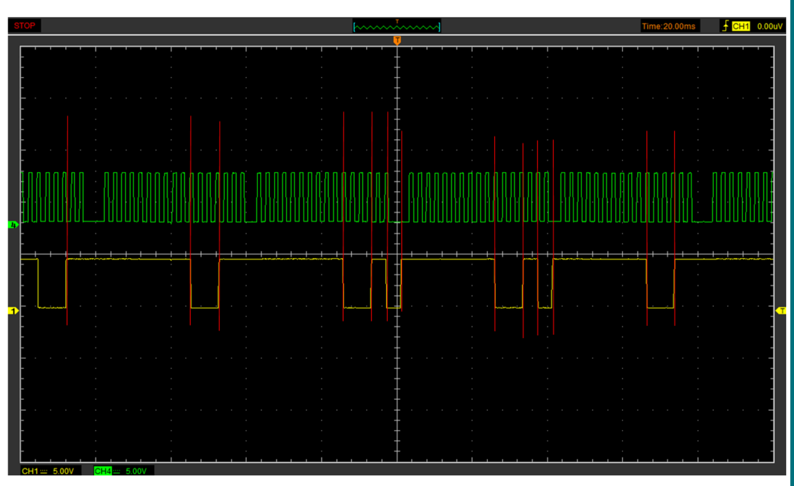
Electrical diagram in Proteus



Component	Connection	Function
Potentiometer	➢ Connect pin A0 of Arduino board	Generate voltage value to simulate speed of crankshaft and camshaft
Arduino Uno	➢ Connect to Potentiometer through pin A0 ➢ Pin 7 connect to Port A ➢ Pin 4 connect to Port C ➢ TXD connect to RXD of Virtual terminal ➢ RXD connect to TXD of Virtual terminal	Read and calculate voltage from potentiometer ⇨ Generate digital output pulse at pin 4 and pin 7
Display	• Oscilloscope: ➢ Port A connected to pin 7 of Arduino ➢ Port C connected to pin 4 of Arduino • Virtual terminal: ➢ Pin RXD connected to pin TXD of Arduino ➢ Pin TXD connected to pin RXD of Arduino	• Oscilloscope : display digital output signal of Crankshaft and Camshaft • Virtual terminal: display RPM and frequency.



Digital output of crankshaft and camshaft in different speed



Sample of digital output signal of M.EXPANDER

V. DISCUSSION AND CONCLUSION

DISCUSSION

From observation between simulated signal and actual signal of Crankshaft and Camshaft. For any change of speed, we completely generate digital output of crankshaft and camshaft without any deviation, 100% accuracy

CONCLUSION

Through simulating the signal of crankshaft and camshaft position sensor, we have better understanding of how the sensor works and basic usage of Proteus and Arduino software

Thanks to these programs, it helps to satisfy the following conditions:

Simulate speed of crankshaft and camshaft
Calculate desired frequency
Generate two digital output signal for crankshaft and camshaft