

## Automatic Transmission System

Puneet Kumar Sharma<sup>1</sup> Virendra Sangtani<sup>2</sup> Md. Asif Iqbal<sup>3</sup>

<sup>1,2,3</sup>Department of Electrical Engineering

<sup>1,2,3</sup>Poornima College of Engineering, India

**Abstract**— Automatic control of the clutch is the key development in the improvement of electronic control and mechanical automatic transmission. A control course of action of Automatic clutch is analyzed which depends on the dynamic direct of the method of clutch responsibility and execution appraisal rundown of consolidated assessment. The control system of the clutch duty process is chosen and it is moreover applied to littler than expected cars. The hardware and programming of a little scope clutch automatic control system are arranged furthermore, realized. The system decreases the driver's work power satisfactorily and improves the vehicle's idea of force starting and moving.

**Keywords:** Automatic Transmission System, ACS, AMT

### I. INTRODUCTION

The conventional contact clutch is the premise of Small scale vehicles automatic clutch ACS Automatic Clutch System, the ACS cancels the conventional clutch pedal, and makes the automatic control of the clutch come to truth. So it diminishes the driver's workforce and makes the clutch commitment will in general be flawless [1]. The ACS expands the vehicle's

amazing presentation and improves the effectiveness of burning. Simultaneously, it is additionally the key innovation of auto-clutch AMT (Automatic Mechanical Transmission) system. The investigation of ACS is a significant theoretical and practical value. The system right now planned with electric-driven, contrasted with different types of driving, and electric-driven has a straightforward structure, high accuracy and is easy, particularly for scaled-down autos.

### II. THE GENERAL STRUCTURE OF CONTROL SYSTEM

The automatic clutch control system is gathering ongoing procurement signals, for example, slows down sensor signal, moving power sensor signal and the clutch position sensor signal. Also, the system should have the option to speak with the engine ECU furthermore, read the present speed, throttle, etc. At that point, it makes sensible decisions as indicated by controlled programming. Finally, the system will yield the fitting sign to drive the engine and show the present slows down and issue conditions. The graph of the structure of the electronic control unit is appeared in figure 1.

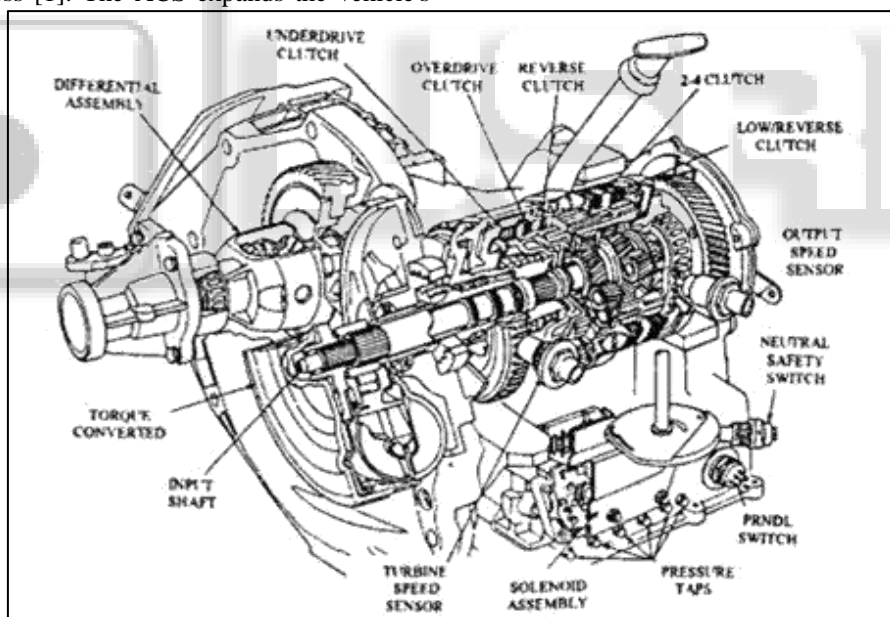


Fig. 1: Electronically controlled automatic transmission for front-wheel drive vehicles

#### A. The Circuit Design of Hardware System:-

##### 1) The Selection of Microcontroller:

This system requires more sensor data than others, what's more, need to out PWM pulse width modulation signal so as to drive the DC engine. Right now, select elite, low power 8-bit microcontroller Atmega16 which is created by ATMEL. The AVR microcontroller has a rich fringe interface, including 4-channel PWM signal yield, 8-channel also, 10-bit ADC, just as a programmable guard dog clock that has the autonomous on-chip oscillator and so on. It can gather multi-sensor information effectively without outside simple advanced change chip. What's more, it has a 4-channel PWM

signal yield, just expecting to set the comparing register, with the goal that it can yield PWM signal effectively, without an extra devoted PWM signal molding circuit. In this manner, this system utilizes the AVR microcontroller of atmega16 so as to accomplish the grasp programmed control works effectively; it upgrades dependability when contrasted with the utilization of outer hardware.

##### 2) The Realization of Fast and Slow Clutch Movements:

The control law we can see from the clutch is "fast - slow - fast". It will unavoidably include the speed issues of authorization organizations. This structure utilizes the BHBT-BLDC8085 brushless DC motor which is imagined by BHP Billiton Electric Co. The recipe of brushless DC motor

mechanical properties is as follows.  $n$  speaks to for speed,  $U_c$  speaks to for the armature Voltage.  $R$  speaks to the armature circuit obstruction.  $\Phi$  speaks to for the attractive motion per post,  $K_e$  and  $K_t$  speak to for the motor structure constants When the other variables are constants, the speed  $n$  is proportional to the armature voltage  $U_c$  from this formula.

$$n = \frac{U_c}{K_c \Phi} - \frac{R}{K_c K_t \Phi^2} T \quad (1)$$

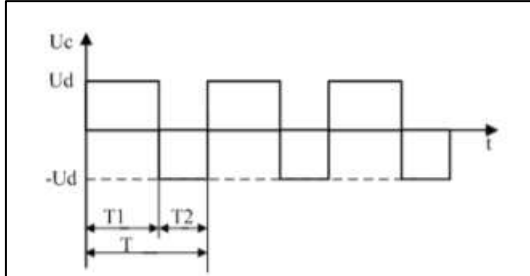


Fig. 2: PWM Wave diagram

$U_c$  is for the armature voltage in the figure, and  $U_d$  is the armature voltage which is added to the armature ends. Their connection is as per the following.

$$U_c = \left\{ \frac{T_1 - T_2}{T_2 + T_1} \right\} U_d = \left\{ 2 \frac{T_1}{T} - 1 \right\} U_d = (2\alpha - 1) U_d \quad (2)$$

$\alpha$  is known as the duty cycle, we can change the duty cycle, also, in this way the armature voltage is changed. Finally we can control the speed.  $\alpha$  reaches from 0 to 1, at that point  $U_c$  is in the scope of  $-U_d \sim U_d$ , so the motor can be sure and negative in the two bearings on the running.

Clear from the earlier, brushless DC motor can be controlled speed by PWM. This arrangement puts the PWM signal authentically to the Avr microcontroller, in order to control the speed; furthermore, the sensible necessities of the clutch can in like manner be met.

The software of the system is made and requested in the ICC AVR integrated headway condition. It is simulated in the entertainment arrange on the AVR Studio. Speed program is obliged by timer/counter 1 and the PWM wave is yield. The extent of OCR1B and OCR1A is the duty cycle for this work mode, by altering OCR1B, the speed can be controlled.

The intensity of frameworks is the vehicle's 12V battery. In the driving procedure, the battery can be revived by the vehicle generator [3]. Along these lines guaranteeing the force supply is continuous. As the working voltage of MCU framework is 5V, we need to change the 12V to 5V

provided by 7805. Since from 12V to 5V, a voltage drop will be moderately huge, prompting the voltage regulator warmed, so it very well may be harmed no problem at all.

Clutch position sensor and detection circuit: -At the point when the clutch should be isolated or fortified, the system requirements to get the present area data of a clutch. In the system, a position sensor is introduced on the clutch implementing agencies [4]. It is utilized to recognize the separation which is from the clutch to the beginning stage which is set by the system. Inside it, there is a sliding potentiometer, the executing agency slider to drive potentiometer sliding contact. In this way, the adjustments in the yield voltage can be utilized to portray the adjustment in the clutch position. The recognition circuit is appeared in Figure 3.

In Figure 3, the position which is outputted by the location circuit can be legitimately gotten the Atmega16 MCU 8-channel ADC converter circuit arbitrary way. so we can without much of a stretch gather data on the grasp stroke.

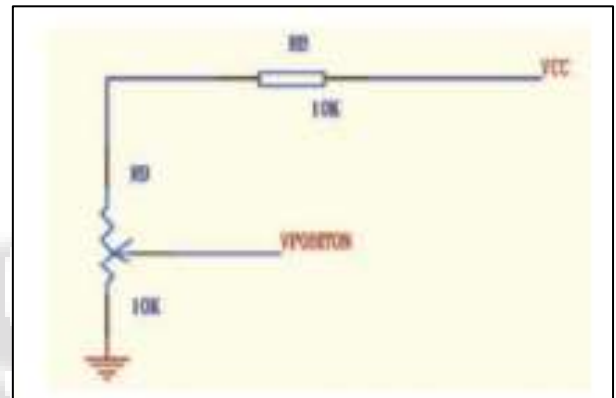


Fig. 3: diagram of clutch position detection

3) Stall sensor and its detection circuit:

Mini car slows down incorporate 7 records and it is "E"-molded game plan. Slows down magnet section is introduced on the shift shaft. The location will change with the shift. The corridor switch element is introduced on the different slows down. At the point when the shift moved to a slowdown, the Hall switch of this slowdown will output high. And afterward through the conditioning circuit, the switch signal is converted to simple signals. SCM will manage it. Figure 4 is a schematic outline of the work for the slowdown sensor.

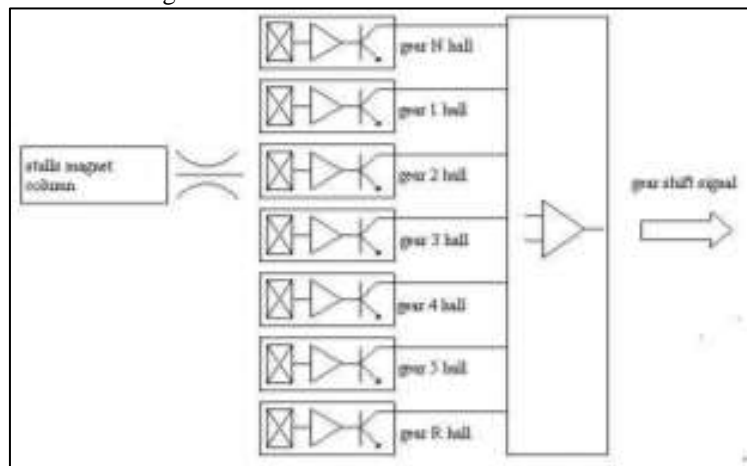


Fig. 4: The diagram of work for the stall sensor

### III. KWP2000 PROTOCOL COMMUNICATIONS ACCESS TO THE ENGINE SPEED AND VEHICLE SPEED SIGNAL:

#### A. The Introduction of KWP2000 in the system:

The K-line KWP2000 Protocol is utilized in mini cars in this system. Half-duplex sequential communication is utilized in K-line communications. Be that as it may, the level it utilized isn't equivalent to the standard sequential port level. Subsequently, we should structure the explicit K-line interface circuits to meet the prerequisites of K-line communications. The K-line communications circuit graph is appeared in Figure 5. In the structure of the genuine circuit,

we utilize half-duplex bi-directional communication interface ASIC chip MC33290 as K-line handset. MC33290 chip has a capacity for example, yield will kill if the temperature is excessively high; short-circuit Protection, and anti-static puncture protection, etc.

In the Figure 5, K-line is a bi-directional port. It is connected with the Microprocessor Common I/O port, and can initiate a session ask for and receive responses message. The three ports on the right hand are connected with the automatic clutch ECU, in this manner completing the communication among microprocessor and the engine ECU.

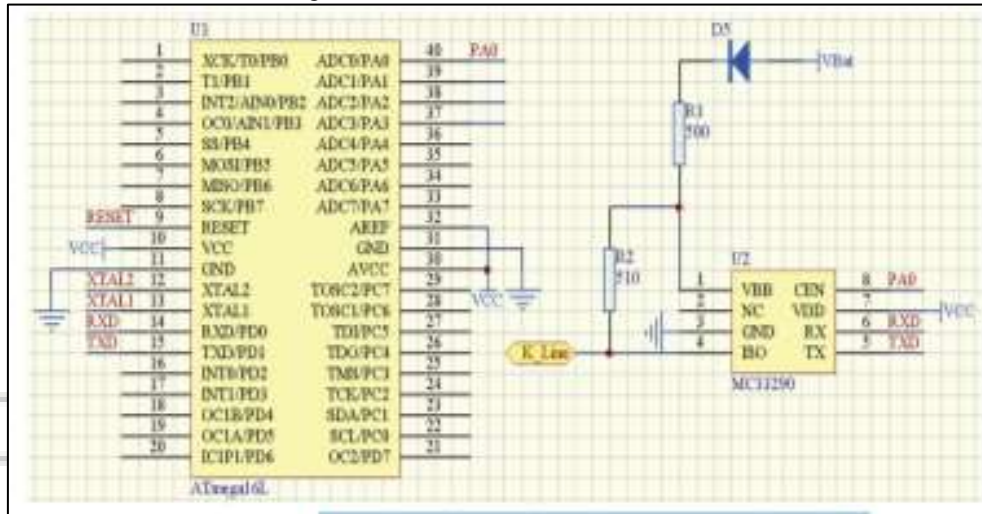


Fig. 5: The interface of K-line communication

#### B. The design for communication process:

KWP2000 Protocol is additionally called ISO-14230 (International Standard). It is utilized to characterize general necessities which are in light of the diagnostic system of the serial data connection. This understanding incorporates a physical layer, data link layer, and application layer.

##### 1) Physical layer:

It is really the physical layer characterized in ISO 9141-2. It is extended to work in 24V frameworks. It implies that vehicles, modules, or test equipment which meets the ISO 9141-2 will meet the interface necessities of KWP 2000, on the off chance that we as it were alter the software. The rationale "0" on the communication transport is characterized as 20% ~ 30% of the battery voltage, the rationale level "1" is characterized as 70% ~ 80% of the battery voltage.

##### 2) Data link layer:

This layer is primarily used to depict the message structure in communication Of KWP2000. The understanding was marked by three sections: message header, the number of bytes, and checksum. Among them, the length of the message header isn't fixed, can be made out of up to 4 bytes. The information bytes can have the most 255 bytes. Likewise, the technique for communication in statement is characterized.

##### 3) Application Layer:

This layer gives necessities to accomplishing an assistance agreement. Counting administration set identifier character encoding segments, hexadecimal values, byte code of the administration solicitation and reaction, the hexadecimal estimation of standard parameters.

KWP2000 understanding gives the planning of the communication process. It is appeared in figure 6. The planning parameters are characterized in Table I below. The data link layer is liable for dealing with the planning parameters between the P1 furthermore, P4. The time among messages and messages which is named P2 and P3 are dealt with by the application layer.

Parameter Name	Description
P1	Timing for Inter-byte packet
P2	Request for diagnostic unit and the time between ECU responses or two ECU responses
P3	the time between the end of ECU response and the new request of the diagnostic equipment
P4	the time between byte packets which are requested by diagnostic unit

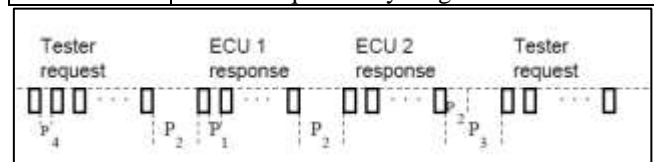


Fig. 6: The timing treatment of KWP2000

#### C. The design for communication process:

The correspondence between analytic equipment and the engine ECU includes Initialization and Receiving and sending messages

1) Initialization:

Prior to demonstrative services, indicative apparatus must instate the motor ECU with the goal that communication association can be set up. Right now, tells symptomatic equipment the source address of ECU, communication baud rate, the configuration of parcel header which is supported, timing parameters and other information by watchword.

2) Receiving and sending messages:

The fundamental capacity of data link layer in engine ECU is getting and sending messages. When the diagnostic types of gear send messages to the ECU, ECU data link layer can acquire the first piece stream from the physical layer. And afterward re-joined to shape messages, give these messages to the application layer. At the point when the ECU sends messages to diagnostic unit, data link layer access to diagnostic data first from application layer. Split them into a message which is suitable for K-line transmission. The information flow which is appeared in table1 can be perused by analytic contraption and the engine ECU. 01h Mode—require for the current power system analytic information. This mode permits access to the information which is connected with emission, including simple input and output, digital input and output, the information of the system status. Each assistance demand contains a parameter identification code PID, PID shows the kind of information to the OBD system. Not all the PID in the understanding is supported by the system. There are a few differences between the various models. Outer devices can sent "PID = 00h" to the vehicle ECU, in the brought reaction back, we can see whether PID01h-20h be bolstered or not, from the type of bit code. AVR microcontroller's sequential port baud rate is set to 10400bps. Microcontroller and ECU transmit parcel, and MCU access to engine speed, vehicle speed and other data.

time	AVR Micro-controller	Sending Message by MCU	ECU
	Initialization rapidly		
	Starting communication request	0x81,0x11, 0xF1,0x81, 0x04	
P2			Starting communication and response positively [KB1,KB2]
P3	Start to diagnose the request for conversation	0x82,0x11, 0xF1,0x10, 0x81,0x15	
P2			Begin to diagnose and response positively
P3	Request for the current power system data (PID=00h)	0x82,0x11, 0xF1,0x01, 0x00,0x85	
P2			Request the current power

			system data to response positively
P3	Request for the current power system data (PID=0Ch)	0x82,0x11, 0xF1,0x01, 0x0C,0x91	
P2			Request the current power system data to response positively

D. The programming of the test for starting point of the clutch engagement:

Precisely discover beginning stage of the clutch engagement is an significant condition for the control of clutch. In the event that the measured beginning stage is wrong, clutch engagement procedure will be hard to complete true to form. Furthermore, the wear and tear of clutch friction plate will prompt the difference in the area of the beginning stage junction. The effect of temperature changes during the time spent driving will bring about incredible effect on the clutch engagement process. At present, the technique which is broadly utilized abroad is to decide if find a workable pace point position by the speed changes of gearbox input shaft anyway this strategy should introduce the applicable sensors, with the goal that it can monitor the speed of gearbox input shaft. This technique will increment the expense of the entire control system. Right now, utilize the accompanying strategy to decide the location of beginning junction point. The rule is as per the following. At the point when the location of the grip engagement point is resolved, the opening of engine throttle stays unaltered, and afterward the vehicle is in the stopping state. At the point when contact the ace circle of clutch with the slave plate of clutch, the engine which is in activity under steady speed will decrease the speed in view of the impacts of abrupt burden. In any case, the decline of the speed has the extraordinary relationship with the speed of the clutch commitment. So we can decide the situation of the clutch commitment point by the speed of initial clutch commitment and the decline in engine speed. The flowchart of the program is shown in Figure 7.

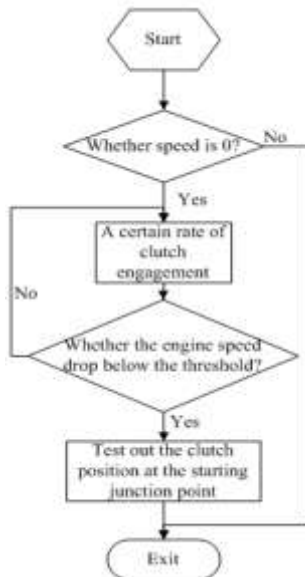


Fig. 7: The flowchart of the program

#### IV. CONCLUSION

An automatic control system of lock planning to mini automobile has been designed and implemented in the paper. Besides an example system has been manufactured and operating effectively. The system has minimal effort and high steadiness. It has wide application.

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