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On 17th & 18th March 2016

Automated Manual Transmission for Two wheelers

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ABSTRACT: Automated Manual Transmission (AMT) is an electro-hydraulic mechanism for automating the manual transmission systems present in the vehicles. Currently, most of the vehicles on road have manual transmission systems, in which the controlling of the vehicle, in every way is done by the user. In technical terms, the driver of the vehicle must manually press the clutch pedal, in order to change the gear and ultimately change the speed of the vehicle. And this is a very tiresome process in heavy traffics and of course causes great discomfort. Here is the relevance of AMT where the clutch controls and gear shifting is fully automated. AMT is already implemented in some cars like that of Ferrari and Maruti, but not in two wheelers due to the bulky size of hydraulic parts. In our proposed system, we try to develop an AMT system for two wheelers fully based on an electronic control unit, which intakes the values from different units like rpm sensing, speed sensing, clutch control, gear sensing units etc. and control the gear shifting.

I.INTRODUCTION

A manual transmission or sequential type is a type of transmission used on motorcycles and cars, where gears are selected in order, and direct access to specific gears is not possible. With traditional manual transmissions, the driver can move from gear to gear, by moving the shifter to the appropriate position. A clutch must be disengaged before the new gear is selected, to disengage the running engine from the transmission, thus stopping all torque transfer whereas the Automatic Manual Transmission is one type of motor vehicle transmission that can automatically change gear ratios as the vehicle moves, freeing the driver from having to shift gears manually and to achieve efficient driving.

Automatic transmissions tend to be larger and bulkier and are usually not considered to efficient than MT's.

However, over the past few years, a lot of work has been done and the latest generation of automatic transmissions are extremely efficient due to the addition of variable ratios as well as dual clutches (DCT) which makes them shift between gears at efficient points depending on certain engine parameters as well as the driver controlled throttled input. However, owing to the basic architecture of an automatic gearbox that has the bulky "torque converters" that contains the transmission fluid to allow gear changes, the addition of additional gears and clutches makes them larger.

1.1 Automated Manual Transmission

An AMT consists of a fully functional manual transmission complete with the clutch. However, instead of having to physically use your left hand to press the clutch pedal, an electro-mechanical actuator will be used to perform the function of the human hand. The control logic behind making the transmission shift at the optimum points with minimum amount of gear shift time is carried out by a supervisory controller. In order to develop the AMT for two wheelers, the main focus will be in the Transmission Control Unit, which will combine the various outputs from different sensing units and decides on shifting of the gear relying upon the speed of the vehicle, of course. For the TCU to function efficiently, feeds from rpm sensor, gear sensor, speed sensor and drive mode information are required. Based on the analysis of these data the TCU provides signals to the clutch and gear actuators. The block diagram

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symbolizing all these is shown further in the report.

II. LITERATURE SURVEY

A transmission is an integral part of any vehicle no matter what its application is. The automotive industry started out with a manual gearbox in which the clutch inputs and gear changes were provided by the driver. This means that the driver has to physically couple and decouple the transmission from the engine drive shaft. Coupling a gear mean that the transmission and the engine are both turning at the same time, thereby "transmitting" the power developed by the engine to the wheels via the transmission.

2.1 Current Transmission Techniques Used In Two Wheelers

A manual transmission was originally completely mechanical although over time electronics have been integrated to make them more sophisticated and more number of gears have been added. Addition of more number of gears enables in having more gear ratios which thereby helps with fuel efficiency as well as with operating the engine at its optimum loading point.

In automatic transmissions, clutching inputs and gear changes are done by the transmission using hydraulic fluids. Automatic transmissions tend to be larger and bulkier and are usually not considered to efficient than MT's. However, over the past few years, a lot of work has been done and the latest generation of automatic transmissions are extremely efficient due to the addition of variable ratios as well as dual clutches (DCT) which makes them shift between gears at efficient points depending on certain engine parameters as well as the driver controlled throttled input. However, owing to the basic architecture of an automatic gearbox that has the bulky "torque converters" that contains the transmission fluid to allow gear changes, the addition of additional gears and clutches makes them larger.

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An AMT is composed of a dry clutch, a gearbox, and an embedded dedicated control system that uses electronic sensors, processors, and actuators to actuate gear shifts on the driver's command [1]. This removes the need for a clutch pedal while the driver is still able to decide when to change the gear. The clutch itself is actuated by electronic equipment that can synchronize the timing and the torque required to make gear shifts quick and smooth. The system is designed to provide a better driving experience, especially in cities where congestion frequently causes stop-and-go traffic patterns. AMTs have been used in racing cars for many years, but only recently have they become feasible for use in everyday vehicles with their more stringent requirements for reliability, cost, and ease of use. The automated manual transmission (AMT) is an intermediate technological solution between the manual transmission used in Europe and Latin America and the automated transmission popular in North America, Australia, and parts of Asia. The driver, instead of using a gear shift and clutch to change gears, presses a + or – button and the system automatically disengages the clutch, changes the gear, and engages the clutch again while
modulating the throttle; the driver can also choose a fully automated mode. AMT is an add-on solution on classical manual transmission systems, with control technology helping to guarantee performance and ease of use [2].

III.BLOCK DIAGRAM AND DESCRIPTION

The block diagram of the proposed AMT is shown in fig 1,The main parts of an AMT are engine RPM sensor, clutch actuation unit, gear controller, speed sensor, accelerator control, a gear indication display, and switches to shift up or down the gears and to choose between automatic and manual system.

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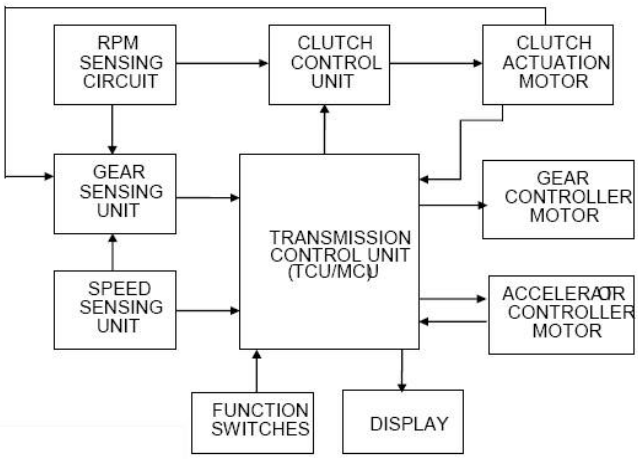

Fig.1 Block Diagram

3.1 Rpm Sensing Unit

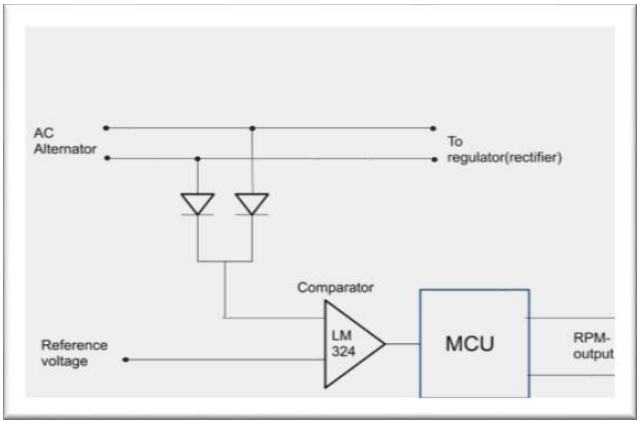

Fig 2. Rpm Sensing unit

The engine rpm (revolutions per minute) is the rate by which the crank shaft rotates [3] .It had to be detected for finding the rate at which the shaft rotates. On searching about detecting the rpm from engines, basically two ideas were deduced out. One was attaching a coil to the spark plug used with the engine to ignite the combustion. On doing so, we could count every spark and from that the pulses can be calculated. The other idea was to take alternator output, which was used to power up all the systems in the vehicle. Since taking the alternator output from the wire attached seemed to be easier, this method was adopted. To convert the rpm output to rpm for over use, the following circuit was formulated. The AC output from the alternator was first rectified and given to the comparator LM324. The output ranged between 0 to 3V and a reference voltage of 1.5V was chosen accordingly. The pulse output from comparator was given to the microcontroller . In order to get the rpm from the pulse output, the pulse was first counted. The rpm output from this is then taken to the clutch and gear sensing units respectively.

3.2 Gear Shifting Unit

The gear shifting is actuated by two independent motors, one for shifting up and another for shifting down. When a

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shift up signal is given to the transmission control unit it energizes the gear up motor and the gear is shifted, and when the gear down signal is given to the transmission controller it energizes the gear down motor and in turn it will shift down the gear. Two motors are used to improve the accuracy, rather than using one.

3.2 Clutch Actuation Unit

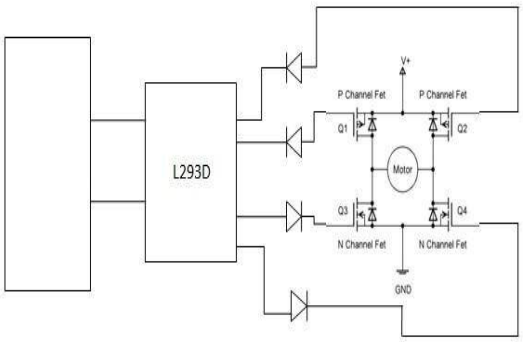

Fig 3, Clutch actuation unit

Clutch is a mechanical device that engages and disengages the power transmission from engine to the tiers. In simple words, the clutch engages and disengages the engine driving shaft and the wheel driving shaft for the purpose of gear shifting. In two wheelers the clutch is controlled by pulling the clutch cable, on which it releases the engine shaft from the wheel shaft, and at this time we change the gear. Our aim is to automate this on the basis of rpm sensed. We removed the clutch liver cable and connected it to a wiper motor M800, whose actions where controlled by the microcontroller using the driver L293D. The motor was controlled through four MOSFETs- IRF4905 and IRF 3205.When the clutch is engaged power flows from engine to rear wheels and when it disengages no power transmission occurs and vehicle stops while engine is running.

That is clutch is engaged I situations like when starting the engine, gear shifting, stopping the vehicle and when idling the engine. Clutch is engaged when vehicle is moving. Clutch prevents the jerky motion of vehicle and permits gradual taking up of load. In two wheelers, for gear shifting and other purposes we are using clutch and it results in pulling of clutch cable in forward and backward direction. When automated, this has to be removed and another system has to be formed for controlling the clutch. For this, it was decided to use a motor to pull and push the clutch cable. Wiper motor M800 is preferred here which is easily available, robust and powerful.

3.4 Transmission Control Unit

The Transmission Control Unit is the key functioning unit of our whole system. The TCU is designed in such a way that it controls each and every function of each single unit. It takes the input from the rpm sensing unit, the speed sensing unit and the gear sensing unit. On analyzing these inputs the TCU takes the final decision on whether incrementing or decrementing the gear. The unit also intakes information such as the position of the clutch, based on which decision on half clutch pulling and releasing is done. The vital data like that of the brake, power relay and the ignition system information are also given as input to this unit, so that it can have a control all over the system. It is meant to provide a system over ride on the application of brakes. Some additional features like a display, to show the current mode of moderation and the current operating gear along with switches to select the current operating mode, that is manual over ride or fully automated is also included. All these are controlled by the TCU, which can be thus otherwise called the Main Control Unit. The TCU circuitry is meant to be connected with all other parts and also have to control various functions at a time.

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IV.CIRCUIT DIAGRAM

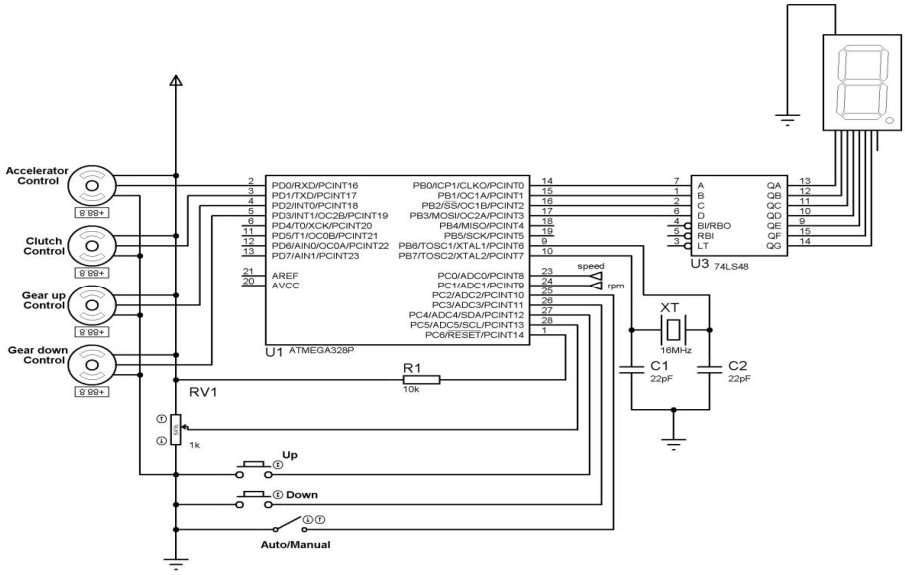

Fig 4, Circuit Diagram

The running speed and engine RPM are fed to the transmission control unit (ATmega328P).A drive select switch is there to choose between fully automatic and automated manual gearing. When the fully automatic mode is on the Transmission control unit will automatically shift between the gears with respect to the engine rpm and running speed at maximum efficiency points. While in automated manual mode, the gear shifting is assisted with auto clutch according to the user's desire. When the shift up button is pressed the clutch is automatically disengaged and the gear up motor will shift one gear up and then engages the clutch.

V .CONCLUSION

AMT is an idea under incubation for the past few years. It has been used in many four wheelers, but not in two wheelers due to the bulk size of hydraulic engines. If AMT needed to be brought in two wheelers it was only possible through a fully electronic control system. And in our system, we are just proud to say that, we have achieved it to a great extent. We are successful in controlling the clutch and gear and its shifting accordingly. The advantages of AMT besides the ease in driving and vehicle control in heavy traffic, it really makes the vehicle fuel efficient. Now the present technologies are focused in developing fuel efficient vehicles and this is an important part of it [4]. With AMT, we can achieve fast transmission between gears and speed change. This reduces the wastage of fuel during slowing down of the vehicle, to change gear. Thus fast shifting of gears add on to increasing the mileage of the vehicle, compared to the others. When considered for a detailed study, it can be seen that the advantages of this system does not end here and can be further extended in technical and commercial terms. Our system is just a primary initiative and it has much future prospects. With more precise calculations and components, this can be improved further. We hope to develop this idea to a more advanced and perfect mechanism as such it can be commercialized in the future.

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