

Digital Gear Level Indicator

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Abstract:

This paper briefly describes the successful implementation of a Digital binary counter based Gear level Indicator in a motorcycle. The breakthrough attained in this project is the ability of this system to indicate the 'GEAR LEVEL' in a motorcycle.

In a motorcycle determining the current Gear level of the vehicle becomes very necessary at critical situations like very high or very low speeds. The Digital gear indicator helps in determining the gear level, thus helping the driver to avoid accidents. The Digital gear indicator uses a simple Up/down counter and a digital display to record the data and display it to the driver.

This application note describes in detail, the challenges faced during the practical implementation of the system. It also describes the circuit used in the implementation of the system.

Keywords: **Gear level indicator, Up/Down counter, digital display.**

I. Introduction

What lead to the design and fabrication of the Digital gear level Indicator?

A beginner/intermediate motorcycle driver makes the mistake of wrong transition of gears at critical situations like very high and very low speeds which leads to engine getting switched off at places where it is not supposed to switch off. It may even spoil the gear shift mechanism of the engine. Thus a simple, efficient, accurate, inexpensive system was necessary. This lead to the

design and development of the Digital gear level indicator.

II. What is Digital Gear Level Indicator?

The Digital Gear Level Indicator is a simple digital system which can indicate the Current gear level in a motorcycle. It is designed to collect data of the current gear level and indicate it to the driver through a display which could be integrated along with the speedometer panel.

III. What is unique about the Digital Gear Level Indicator?

The uniqueness lies in the ability of the system to display the gear level of the motorcycle immediately when the transition takes place from one level to the other instantaneously through a digital display. No other system is currently available which has this feature. The system is very cost-effective, accurate and easy to use. With further development the system can be used in other Geared vehicles like cars which have Non-linear transition of gears.

IV. Where can it be used?

At present The Digital Gear Level Indicator can be used in motorcycles having linear transition of gears.

V. What are the hardware requirements?

1. A 3 bit Up/Down synchronous counter.
2. A 7 segment display.

VI. How does it work?

In general a vehicle has N gears, but a counter of N+1 state are required since the neutral state should also be taken into account. Normally a motorcycle has 4 gears. Thus a counter which is capable of counting at least 5 states is required. So a 3 bit counter is used. Fig.3 shows a 3-bit Up/Down counter.

The system is fed with a positive clock pulse when a gear is shifted up and a negative clock pulse when the gear is shifted down.

- When a gear is shifted **up** the circuit works as shown in the fig.4, thus counting one state **up**.
- When a gear is shifted **down** the circuit works as shown in the fig.5, thus counting one state **down**.

In this way the counter records the data about the gear transition and the data is displayed on the display through a driver like the IC 7447 BCD to 7-segment display driver.

Block diagram

Input pulse from the gear shift mechanism

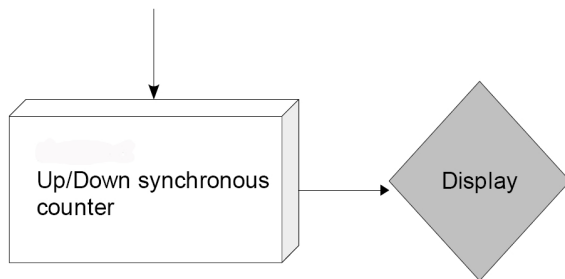


Fig. 1: Block diagram of the system.

Fig.1 shows the block diagram of the system. The Block diagram explains the system very briefly. When a gear shifts **Up** or **Down** an input pulse is sent in to the system which records the state accordingly and displays it on the display.

State diagram

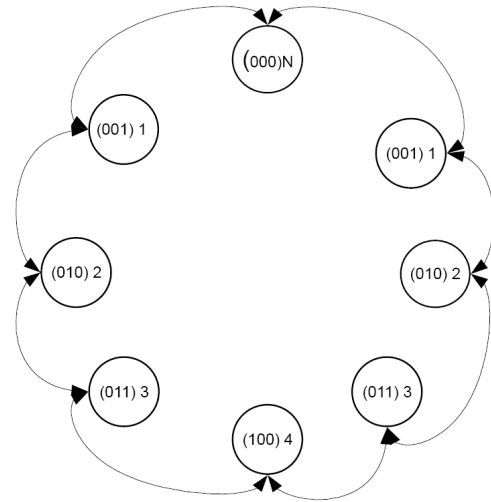


Fig.2: State diagram

Fig.2 shows the State diagram of the system. The counter counts one state **Up** or one state **Down** at every instant. The system is capable of counting up to gear level 4 or the 5th state.

Down

Present state			Next state		
Q ₂	Q ₁	Q ₀	Q ₂	Q ₁	Q ₀
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	-	-	-

Up

Table.1: Truth table.

Table.1 depicts the truth table of the counter. The 3-bit counter is capable of counting up to (111)₂ or 7, but when the system is implemented on to the motorcycle it is capable of counting only up to (100)₂ or 4.

VII. Design Circuit

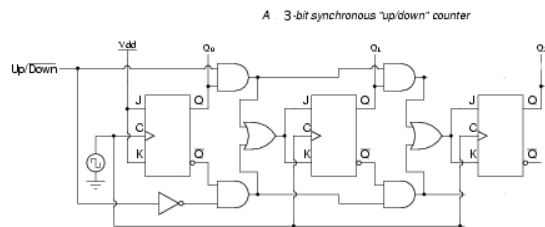


Fig.3: 3-bit up/down counter

Fig.3 shows the circuit of the 3-bit **Up/Down** counter. The circuit uses 3 **J-K** flip flops since it is a 3 bit counter.

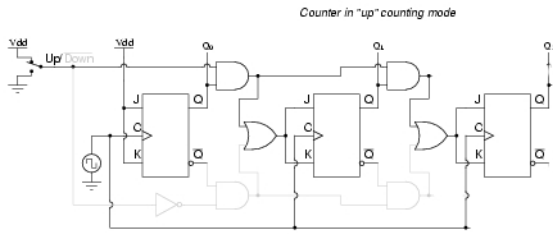


Fig.4: Counter in Up counting mode

Fig.4 shows the counter in Up counting mode. When the switch is in the **Up** position the **AND** gates in the upper part is enabled and thus gates a signal through the **OR** gate which makes the input to the J-K flip flop. The **AND** gates in the lower part is disabled due to the **NOT** gate.

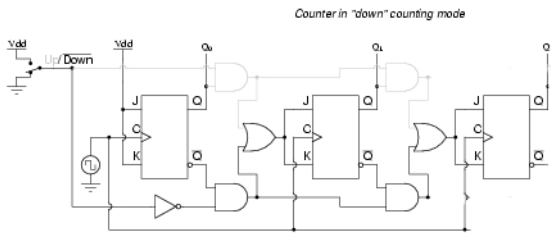


Fig.5: Counter in Down counting mode

Fig.5 shows the counter in Down counting mode. When the switch is in the **Down** position the **AND** gates in the upper part is disabled. The **AND** gates in the lower part are enabled which gates a signal through the **OR** gate which makes the input to the J-K flip flop.

Extra feature: The manual Reset facility.

The manual Reset facility is a feature which resets the counter in some motorcycles which have the facility to suddenly jump to neutral state.

When the driver uses this sudden shift mechanism a pulse is sent to the flip flop Which clears all the output bits making the display to show $(000)_2$ or N.

VIII. Implementation Challenges

The main challenge faced during implementation was

- To integrate the system on to the vehicle, since a lot of heat exchange takes place between the environment and the vehicle. In any vehicle if there were N number of gears then a counter with N+1 number of states was required since the neutral state was also to be displayed. An N+1 state counter would generally be a Non-binary counter.
- In some vehicles the gear transition will not be symmetric, thus making the implementation difficult.

IX. Conclusion

The **Digital Gear Level Indicator** was successfully designed and tested. It was found that the implementation of the system on to the vehicle helps the targeted user to a great extent.

X. Future work/Scope for improvement

- With further improvements the system could be implemented on vehicles with non-linear gear transition systems like car or bus.
- Improvements in the circuit design and working could lead to the implementation of the system to machines having gear transition systems like the Lathe.
- Further the output could be converted to voice.

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