**REVIEW ON UTLP BASED DIGITAL SPEEDOMETER WITH FUEL CONSUMPTION CONTROL USING RF TRANSCEIVER**

1. **GANESH KUTE, 2. BHUVANESHWARI JOLAD, 3. SANDIP WANKHEDE, 4. SURAJ UGALE.**

1.2.3. Pad. Dr. D. Y. Patil Institute of Engineering & Technology, Pimpri, Pune-18  
E-mail: ganesh.kute.0@gmail.com, b_jolad@yahoo.com, sandie.wankhede@gmail.com, suraj.ugale.198@gmail.com

---

**Abstract** - The consumption of fuel is increase in metropolitan cities due to enhanced trip lengths, shift of modal share towards personalized modes of travel and congested intersections. When the vehicles are at signal and waiting for signal to be green, many drivers does not switch off their vehicle and this will results in unwanted fuel consumption. Small amount of fuel wasted, aggregated over number of cycles per day, number of days per month and number of signalized intersections become huge quantity. Interfacing between external input and UTLP kit is done by the GPIO port which is at UTLP kit. Implementing Digital Speedometer with Fuel consumption control using RF transceiver, reduction of fuel consumption at traffic light signal and calculation of current Speed and Distance travel by particular vehicle takes place.

**Keyword** - Unified Technology Learning Platform (UTLP) Kit, RF Transceiver module, Fuel Consumption control.

---

**I. INTRODUCTION**

To implement Digital Speedometer with Fuel consumption control using RF technology a microprocessor comes out as a simple and cost effective solution. But, on choosing omap3530, it has a large amount of code and data memory and sufficient RAM to accurately solve the given problem. It has an inbuilt oscillator so we did not have to connect an external crystal. The display used in an HD44780 compatible 16x2 character display. A speedometer or a speed meter is a gauge that measures and displays the instantaneous speed of a land vehicle. A computer converts the pulses obtained from Reed-magnet mechanism to a speed and displays this speed on an electronically-controlled analog-style needle or a digital display. Pulse information is also used for a variety of other purposes by the ECU or full-vehicle control system, e.g. triggering ABS or traction control, calculating average trip speed, or more mundanely to increment the odometer in place of it being turned directly by the speedometer cable. Now a day’s many wireless controlling technologies are available. One of these most popular is RF technology for wireless control system. Radio Frequency technique (RF) uses a transmitter and receiver for wireless transmission Using which fuel consumption at traffic signal interactions can be controlled. As per documents Specified in literature survey it has been cleared that reduction of Fuel consumption became most essential part in traffic protocols. Using RF technology we can reduce it by automatic turning ON and OFF the engines of vehicle at traffic signal as per the requirement. It is often required to switch electrical switch from a distance without being a direct line of sight between the transmitter and receiver. As you may well know, an RF based wireless remote control system (RF Transmitter & RF Receiver) can be used to control an output load from a remote place. RF transmitter, as the name suggests, uses radio frequency to send the signals at a particular frequency and a baud rate. The RF receiver can receive these signals only if it is configured for the predefined signal/data pattern. An ideal solution for this application is provided by compact transmitter and receiver modules, which operate at a frequency of 434 MHz and are available ready-made. Here, the radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter (and receiver) operating at 434 MHz The use of the ready-made RF module simplifies the construction of a wireless remote control system and also makes it more reliable.

**II. BACKGROUND**

Coming year the people will suffer not only from health risk but also for a place to walk on road. It is just because, in India, the vehicular population in the year of 1951 was just 0.31 Million, in 2009 figure reached up to 115 Million and by 2040, the projected populations of highway vehicles and two-wheelers Would be 206 million to 309 million. The Projected fuel demands by the transportation sector of 404 million to 719 million metric tons (8-15 million barrels/day) and corresponding annual CO2 emissions would be 1.2-2.2 billion metric tons excluding fuel wastage at idling. Global consultancy firm Ernst & Young, states that the Indian market will clock the fastest compound annual growth rate (CAGR 14%) between 2009 and 2020, and it would be more than twice that of China and the triad of North America, Europe and Japan this study Extremely busy traffic junctions of Indore city were selected. Fuel wastage due to bad traffic systems can be reduced by increasing the new vehicles fuel economy and optimizing the traffic control measures. There has been an approved ban on truck idling in the many counties as part of their clean-air attainment plan. To attain the effectiveness of idling-reduction policies, such as incentives and bans, it will be necessary to estimate the emissions reductions...
associated with the decreased idling. The objectives of the study are concise as follows:

As estimated in the study, Pune city generated about 4.7 million tonne of carbon-dioxide equivalents of cumulative and 1.46 tCO2 per capita emissions in 2010–11. Electricity use had the maximum contribution of 56.38% of the total CO2 emissions, followed by petroleum products which generated 36.50%. Municipal solid waste and sewage contributed to the rest of the share. Consumption of petroleum products accounted for the second highest amount of CO2 emissions in the city. During the observation facts were come that about 90% of idle four wheeler vehicles found in Regal crossing during 8AM to 2PM (refer to table) because it is central Indore however during 2PM- 10PM almost 98% of vehicles found in idle condition. Great number of three wheel vehicles was in idle condition at all crossings.

About 92% of three wheel vehicles were in starting condition while waiting for green signal during 8AM to 10PM at Palasia Main because Palasia crossing is at time busy route (AB Road) and many shopping malls and market are situated near the Palasia. Almost all two wheeler at every crossings of Indore found idle.

Consequently 80 to 98% two wheeler was in idle condition during 12hrs observation of sevens crossing for seven days (refer to table). Limited number of heavy vehicles was found at crossing except Bhowarkua and Bengali crossing which are near transport Nagar but in general, all heavy vehicles found in idle condition. It observed that Palasia-1 was most crowded crossing where more than 3400 two wheeler (100cc, 125cc, 150cc and 180cc), 1400 three wheeler (auto rickshaw and other goods three wheeler) and 2800 four wheeler (800cc and 1000cc) found idle (refer to table) during 8AM to 10 PM per day.

In this period of time, 3072 number of two wheeler and 604 numbers of heavy vehicles found idle excluding vehicle in traffic jam. Poor Traffic flow system experienced near the Bengali crossing just because of Bengali square and Khajrana Ganesh Temple.

An effective traffic control needed between 8AM to 10AM& 4PM to 6PM because many numbers of idle vehicles taken into account at that period (refer to table). Schools, colleges and offices are opened and closed at this duration pollution caused in Indore city. More than that of controlling parameters has to be developed to minimize the fuel wastage and global warming potential in Indore.

The traffic volume count at all the intersections in Delhi is not available except for those where traffic volume study has been conducted in past and in this study. The traffic volume count at mid blocks and intersections conducted in previous studies and also in the present study undertaken by Central Road Research Institute has provided extensive data on traffic flows on the road network of Delhi. Employing this data the traffic volume at the intersections in Delhi was arrived at judiciously. Besides this, growth factor method was also used to arrive at the traffic volume of the intersections. It was arrived upon that out of total 600 signalized intersections, 69 intersections are low volume, 118 are medium volume and 413 high volume. It has been worked out that on an average fuel worth Rs.33,996, Rs.27,768 and Rs.53,344 is wasted per day at the low, medium and high volume intersections respectively. The average fuel loss accruing at intersections of varying traffic volumes formed the basis for estimating the fuel loss at signalized intersections in entire city of Delhi. In Delhi, at 600 signalized intersections 0.37 million kilograms of CNG, 0.13 million liters of diesel and 0.41 million liters of petrol is wasted everyday due to idling of vehicles. Converting these Figures into monetary terms, the total losses work out to be Rs.27,25,664 and Rs.53,34,440 is wasted per day at the low, medium and high volume intersections respectively.

The objectives of the study are concise as follows:

<table>
<thead>
<tr>
<th>Time</th>
<th>Square</th>
<th>Four wheeler</th>
<th>Three wheeler</th>
<th>Two-wheeler</th>
<th>Heavy Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>8AM-2PM</td>
<td>Bhowarkua</td>
<td>80</td>
<td>87</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Bengali</td>
<td>80</td>
<td>87</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Mission Station</td>
<td>78</td>
<td>78</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Palasia</td>
<td>87</td>
<td>82</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Regal Square</td>
<td>90</td>
<td>85</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Bhauwad</td>
<td>50</td>
<td>70</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>2PM-10PM</td>
<td>Bhowarkua</td>
<td>87</td>
<td>83</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Bengali</td>
<td>90</td>
<td>85</td>
<td>85</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Mission Station</td>
<td>88</td>
<td>85</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Palasia</td>
<td>95</td>
<td>87</td>
<td>93</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Regal Square</td>
<td>97</td>
<td>83</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Bhauwad</td>
<td>90</td>
<td>55</td>
<td>97</td>
<td>100</td>
</tr>
</tbody>
</table>

### III. BLOCK DIAGRAM

![Diagram of RT Transmitter and RF Receiver](Image 308x628 to 519x770)

"Review on UTLP Based Digital Speedometer with Fuel Consumption Control Using RF Transceiver"

65
IV. RELATED WORK

In this project for calculation of Speed and distance, magnet is pasted on the front wheel of the vehicle. Other circuitry of component like opto-coupler IC (4N35). Reed switch is assembled at front shock-absorber. When the magnet which is mounted on wheel, passes nearby the reed switch, the magnetic contact inside the reed switch takes place which generates the pulse in digital form. Interfacing of this circuitry and UTLP kit is done through 25-pin Simple Digital Interface connector which is also called as GPIO ports of UTLP kit. The pulse generated by the circuitry arrangement is then given to the core processor IC OMAP 3530 of UTLP kit. Then OMAP 3530 IC will perform all the required calculation such as,

\[ \text{Circumference of wheel} = C = 2\pi r \]

\[ \text{Speed} = S = \frac{N \times C}{3600} \text{ km/hr} \]

Where, \( r \) = radius of front wheel in cm

\( N \) = number of revolution per second

\( C \) = circumference of wheel

The distance is calculated on the basis of revolution of the wheel. The distance is updated at every 100 meters and to cover 100 meters the wheel required to make approximately 100/C revolution. Where, ‘C’ is circumference of the front wheel and which is calculated by above given formula. A single trip distance can also be calculated. Using above mentioned formulae gives the current speed and total distance traveled by the vehicle. The speed calculated is further useful to turn-on and turn-off the moped bike i.e. non-gear automobiles. The turn-on and turn-off of vehicle takes place, taking cell start mechanism into account. Cell start mechanism gives the initial sparking to engine to start. RF transmitter CC2500 is fitted on the traffic light signal pole which transmits the countdown of the signal when signal is RED and when the signal is GREEN, RF transmitter does not transmit any signal. The countdown of signal is transmitted at a carrier frequency of 2.4 GHz. Same type of RF transceiver is fitted on the vehicle, which will receive the countdown transmitted by the transmitter at traffic signal. When the vehicle enters into the RF transmitter zone receiver receives the countdown from the transmitter. This Receiver is connected to the UTLP kit through UART. The countdown receive by the receiver is given to the processor OMAP 3530. When the countdown transmitted is greater than 10 seconds, processor checks the speed of vehicle (moped bike), if speed of vehicle is zero (S=0) then with help of relay, processor turn-off the vehicle automatically. When the vehicle (moped bike) is at turn off condition at signal, processor checks the countdown and when time remaining signal to be GREEN is less than or equal 10 seconds then processor turn-on the vehicle automatically with help of relay by sending control signal to relay. This will save 30% of fuel consumed by vehicle.

V. EXTERNAL CIRCUIT

External circuitry consists of reed switch, Opto-coupler IC 4N35 and some supportive components like resistor, capacitor and diode. External circuitry is shown in fig.2. Reed switch used in the circuitry is magnetically operates. When magnet passes nearby to Reed switch then Reed switch operates. When there is a one rotation of the wheel, then reed switch gives a digital pulse (high to low) which is then sent to Opto-coupler IC 4N35.Opto-coupler IC is used to optically isolate the reed switch output from input of processor. Opto-coupler gives digital pulse which is then given to the OMAP3530 IC by GPIO interface through 25-pin Simple Digital Interface connector.

VI. HARDWARE DESCRIPTION

Unified Learning Kit is based on Texas Instruments OMAP3530 application processor & Spartan-6 FPGA co-processor. The Spartan-6 family provides leading system integration capabilities with the lowest total cost for high-volume applications. The thirteen-member family delivers expanded densities ranging from 3,840 to 147,443 logic cells, with half the power consumption of previous Spartan families, and faster, more comprehensive connectivity. Spartan-6 FPGAs are the programmable silicon foundation for Targeted Design Platforms that deliver integrated software and hardware components that enable designers to focus on innovation as soon as their development cycle begins.
RF transceiver used in this project is as shown in fig.4. It has a carrier frequency of 2.4GHz. The RF transceiver is connected to the UTLP through UART interface. It is supported to the three baud rates three baud rate but the default baud rate is 9600.

**Fig.4 RF Transceiver**

The three baud rates supported by RF transceiver and code required to set the as follow,

1. 9600bps BD0
2. 19200bps BD1
3. 38400bps BD2

It has a half duplex communication protocol; it can either transmit or receive the data at a time. It has three modes and their selection command as follows,

1. Transceiver MD0
2. Transmit only MD1
3. Receiver only MD2

If any command for the baud rate and mode is not given then is automatically consider the default command i.e. 9600 baud rate and transceiver mode. This RF transceiver is operated with input supply voltage 5v to 12v. It also has two configurable modes i.e. command mode and data mode. For programming related part of RF transceiver at the traffic signal

**Supporting Appliances:**
The Spartan-6 FPGA supports interfaces such as Ethernet, FPGA HDR2 20-pin Header, Keypad connector(4X4), FPGA Expansion connector, Mictor connector, ADC, 25-Pin simple digital interface connector, Bluetooth module, DAC, LED, Graphical display, 7-segment display, UART Transceiver, 7 segment LED, 16x2 Char LCD, Oscillators (10 & 100Mhz), DDR2 SDRAM, PROM, Dip Switches.

**VII. BENEFITS OF THIS PROJECT**

12 representative signalized intersections of varying traffic volume have been selected in this study to as certain fuel loss during idling of vehicles. In Delhi, 0.37 million kilograms of CNG, 0.13 million liters of diesel and 0.41 million liters of petrol is wasted everyday due to idling of vehicles. Converting these figures into monetary terms, the total losses work out to be Rs.27.25 million per day and Rs.9944.5 million per annum. After the implementation of this project, a total of 30 per cent of fuel savings and 18 per cent savings in the economic loss shall be accrued. In 2010–11, a total of 0.5 Million Metric Tonne (MMT) of petroleum products were sold in Pune, which are estimated to have generated 1.7 million tonne CO₂ emissions. The transport sector generated 51% of the overall emissions from the use of petroleum products. Petrol and diesel were responsible for about 30% and 19% of the emissions from the petroleum products generating 0.5 million tonne CO₂ and 0.320 million tonne CO₂ emissions, respectively. The other large source of emissions was from the consumption of domestic LPG, which generated 0.4 million tonne CO₂ emission. So it will also help to reduce substantial amount CO₂ emission which will be beneficial for the environment.

**VIII. RESULT**

Implementing UTLP based Digital Speedometer with Fuel consumption control using RF transceiver, 25-30% of fuel consumption of vehicle at traffic signal is reduced and also control the pollution to the some extent. Mounting the Digital Speedometer on the vehicle exact speed and distance traveled by the vehicle is recorded with very high accuracy.

**CONCLUSION**

Implementation of UTLP based Digital Speedometer with Fuel consumption control using RF transceiver is very much useful in the point of view repairing and instant result of speed and distance. It saves the consumption of fuel of a vehicle at traffic signal with considerable amount and also some amount of CO₂ emission, hence pollution reduces. This project also has some drawbacks like for implementing this project RF transceiver must be install at every signal. This increases cost of implementation.

**REFERENCES**