**Introduction**

Electronics are ubiquitous in the automotive industry. Microcontrollers run everything from electronic fuel injection, to entertainment systems. Many cars have an onboard trip computer that will display distance traveled average speed and gas mileage to the driver.

Unfortunately for motorcycle riders these electronic innovations have not transferred to bikes. I propose to build a trip computer for the motorcycle enthusiast. A system much like the ones found on cars will have many advantages for motorcycle riders. Due to technical problems there are no gas gauges available to motorcycle riders, with a range function the rider will have a much better idea of when to get gas. Other functions of the computer will be computing average gas mileage, displaying instantaneous speed, and average trip speed, trip distance, and maintenance distances.

**Description**

Shown below is a system level block diagram of the components of the computer:
A rough sketch of the final package appears below.

![Diagram of final package]

**Fig 2**

All Dimensions shown are maximum sizes of the final package.
There will be a user input keypad for the user to select which functions to display. It will be used for setting the system clock, resetting trip odometers, and entering fuel consumption. These buttons will have to be large enough to be used while the rider is on the street wearing gloves.

The package will also have to be weatherproofed. Since unfortunately it is necessary to ride in the rain and for some people storing motorcycles in a garage is impossible. Even the kindest riding conditions are less than optimum for electronics. The packaging will have to be very rugged to withstand vibrations and weather.

The computer I will design will have the following functions: two reset able odometers, a speed indicator, an average trip speed indicator, a clock, a trip clock, average gas mileage, and an approximate range. To measure the speed, and distance traveled I will use a Hall Effect sensor that will be mounted to the wheel of the motorcycle. The approximate range is going to be implemented by the computer “learning” an average gas mileage for the given motorcycle computed from user input of fuel consumption.

To compute gas mileage there are a few existing methods that are typically used. Due to the specific application problems of carbureted motorcycles, which are the majority of motorcycles on the market, none of these will work. This is why I will have the computer keep a record of fuel consumption. This will make the system appeal to all riders instead of those who own a specific model of bike. When the user installs the computer they will input the volume of their gas tank. From then on the computer will have an odometer that resets when the user inputs how much gas is dispensed the computer will keep a running average of the gas mileage from all fill-ups. There will be a reset of this function to be able to track different riding habits.

The odometer functions will be implemented using a Hall Effect sensor. The sensor will detect a magnet placed on the motorcycle wheel, since motorcycle wheels are standardized in
size, the wheel dimensions will be a constant stored in memory. From this sensor it will be possible to calculate speed and distance traveled. I will have two odometers that will be under user control, along with the odometer that is coupled to the gas tank. The two user definable odometers will be able to be reset at any time.

The computer will also have a clock display. This clock will display the actual time. There will also be a trip clock that can be reset at any time. The user will be able to keep track of ride times, as well as have a timepiece attached to the motorcycle.

**Benefits**

The motorcycle trip computer will benefit the average motorcyclist in a variety of ways. With the versatility offered by a microcomputer system it is possible to have the multiple odometers that can be used to track maintenance intervals and keep track of distances traveled on various trips.

One of the biggest benefits of this system will be the range display. There is no way with present techniques to implement a fuel gauge on a motorcycle gas tank. With the range function this will be effectively implemented. This means that riders won’t have to stop open the gas tank peer in and try and see how much gas is left.

Since it is fairly easy to make a very accurate speedometer and odometer from a Hall Effect sensor the trip computer could be more accurate than many older bikes existing instrument clusters. When I first purchased my motorcycle the speedometer would eventually indicate the speed I was going if I held it constant for at least two or three minutes. It seemed that I was always traveling either fifty miles an hour or five, there was no middle ground. Because my speedometer was inaccurate I also have absolutely no idea how many actual miles are on my
bike. With the system I propose to develop faulty gauges could be replaced with the more accurate computer system.

**Comparison**

I have found no product that specifically targets what I am trying to accomplish with this project. There is a company, Fuel Plus, which designs a similar system but for only BMW K-series motorcycles. These bikes are fuel injected so the problems of determining fuel flow are not an issue that they had to address. This computer retails for 229 dollars. I am targeting the average rider who is more than likely riding a carbureted motorcycle, and does not want to spend that much money on an accessory. The only other commercial product that is similar is made by Trail-Tech, again for a different application but similar functions. Their computer is for dirt-bike and enduro riders to replace or augment an existing instrument cluster. This computer makes no attempt at determining fuel consumption. This unit retails for around 90 dollars and is model specific.

In trying to determine what my project should do I have asked the owner of Champion Cycle, the local Triumph dealer, if any such thing existed to his knowledge. He hadn’t heard of anything but was interested as long as it didn’t cost too much. I have also talked to several other riders, they are quite interested in the versatility that the computer would offer but would not be willing to pay a lot for it. For this reason I hope to have this project in a price range somewhere between the two companies that make a motorcycle computer system. I also want to keep this a generic system so that one model will work for all different types of bikes.

**Development**

The heart of the computer will be a microcontroller. I will probably be using one of the Motorola HC12 family microcontrollers because I already know the assembly language and
some of its hardware interfacing. I think the most daunting task will be the user interface programming. To help make sure I have enough programming background to accomplish this I plan on taking Etec 454 during winter quarter.

I plan on implementing the Hall Effect sensor in Etec 377 during the fall quarter of this year. I will test this sensor by hooking it up to a motor operating at a known speed. I will also use the motor to determine the accuracy of my range function having a schedule of “fuel ups” that should result in a specific gas mileage average. I will then simulate a trip using a motor and inputting the “fuel” in the lab. When all this checks out, I plan on mounting it to my bike and heading out for a nice springtime ride to give it a hands on field test.

Unfortunately for the demonstration I will not be able to ride my bike around the third floor, so I will make a PowerPoint presentation of the unit being used outside on a ride. I will have the computer in ET340 and demonstrate the various menus and how data is input.