1. Introduction

The motivation for thinking on the present topic is related to the common usage of two wheelers and the frequenting associated events. A simple example would be the Key Reminder System. It's observed that visuals specific to remind vehicle owners to take the vehicle key is being placed in many corporate offices. This itself reminds the frequency of occurrences. There are also incidences where theft is reported due to the above mentioned scenario. These scenarios remind us the need of this system to be introduced directly to the vehicle. Other is the need for Theft detection mechanism especially Fuel Theft which is reported heavily in urban areas. Information on the replacement of Rear Break Light is another scenario. The rider rarely notices the damage of the rear break light which had a potential of accident from the rear. The intention is to avoid this scenario by alerting the driver as and when the rear break light doesn't work. Battery Power indicator helps in identifying the low battery power and to trigger the recharging of the same. Disc pad replacement is another critical feature. The observation is that when the disc pad is completely weared off and when breaks is being applied, the possibility of wheel getting blocked is quiet high.

In this work, an algorithm to identify the periodic degradation and intimation can be provided when the degradation is nearing 100%. Other topic in discussion is the vehicle service reminder especially the engine oil gets replacement and alert driver in advance when the respective service day is reached.

2. An Overview on Related Works

For key reminder, many proposals have been tried out but a latest technology\textsuperscript{1} provides a hardware which can
be connected with the mobile. The hardware is connected to the key. If the key is forgotten in the vehicle and owner moves out, information would be available in the mobile forcing the owner to take the key. Though this is a good approach, considering the cost of the device and two wheelers a product segment, it makes sense to invest the amount and hardware towards the vehicle. Through this we can implement multiple features.

For vehicle security talks about the wireless control and monitoring of the locking of the vehicle and alerting the owner during theft. More of technology is introduced to the system. However towards the end more hardware and weight is introduced to the vehicle. The people stealing the vehicle can easily dismantle the hardware leading to the effectiveness of the system in question. Simpler solution needs to be looked upon. Having single hardware and multiple features should be of focus.

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For Fuel Theft and Fuel Leakage majorly focuses on the passing of fuel theft information to the owner. It takes the data from the sensor as digital signal to know if the fuel theft has happened. Considering the existing systems like the ones implemented in TVS, we believe the extension of the software could help in identification of theft and fuel leakage.

For Rear Break light damage alert especially for the two wheelers is missing.

Disc pad replacement info focuses on embedding sensors to identify the disc pad replacement. This technology is predominantly used in four wheelers. As the disc pads are now used in high power two vehicles, the possibility of implementing the same needs to be looked upon.

Vehicle Service reminder involves Android application. Here feeding of data for service reminder to be provided to cloud which then identifies the next service duration. The possibility of automatic identification of service can be an improvement over the proposal.

3. Proposed Solution

As explained earlier, the proposed functions are categorized as Security functions and Vehicle functions.

3.1 Security Functions

Two features are defined under security functions which are listed below:

- Key Reminder System.
- Vehicle theft detection and alert.

The advantage of this system is that the same hardware can be configured for both the features with the help of software. The implementation details of this are covered in following sections.

3.1.1 Key Reminder System

As shown in Figure 1 Module 1 consists of microcontroller and accelerometer. A wired Key input is provided to the microcontroller. Logic of the system is explained.

- There is no movement of the vehicle identified (driver not present).
- Key input is high (Key in instead position).
- Timer runs for 10 seconds.
- If 1 and 2 is still valid, provide alarm to the driver. This indicates the key is forgotten.

3.1.2 Vehicle Theft Detection and Alert

If added the below algorithm to the above system we can identify the vehicle theft. The algorithm is explained.

- There is movement of the vehicle identified (someone is present on the vehicle).
- Key input is low (Key not in instead position).
- Timer runs for 10 seconds.
- If 1 and 2 is still valid, provide alarm to the driver.

Figure 1. Overview of Key Reminder System.
This indicates there is an unintended disturbance to the vehicle which could be a possibility of Theft.

3.2 Vehicle Functions

3.2.1 Fuel Theft and Leakage Identification

The existing systems in two wheelers have Analogue Level sensor installed Figure 2. The information of the fuel level is passed to the controller through ADC channel. The proposal here is to introduce logic in the software where the reduction of the fuel level is observed in a specific time which is unusual. The time can be calibrated. When this instance is detected the information is passed directly to the owner through GSM. The owner would now be alert of this situation and one can take appropriate measures. Logic is explained.

- Current tank level is monitored during vehicle standstill. The vehicle standstill information can be taken from accelerometer.
- Input value from Tank level sensor dips drastically in 5 minute duration.
- Inform the driver on the possible fuel theft.

The same circuit would act as Fuel Leakage indicator if the observation is made for a longer time when the vehicle is at standstill.

- Vehicle is at standstill and a constant value is being provided by the Level sensor.
- Input of the level sensor is observed for minimum 1 hour during stand still.
- If the level is constant, then no leakage is identified. If there is a change in level beyond the tolerance limit leakage is identified and informed to driver.

3.2.2 Rear Break Light Replacement Info

Most of the time two wheeler drivers focus towards the front of the vehicle. Rarely do they focus on the working on the break light. If the rear break light gets damaged, they never come to know of the same which is a dangerous scenario. This should be avoided. Figure 3.

3.2.3 Disc Pad Replacement Info

The information of disc pad replacement critical as the same leads to locking of the vehicle, leading to accidents. The idea here is to introduce an Algorithm that could identify and inform the driver about the disc replacement. As the majority of the two wheelers in India have disc pads in the front, the focus here is to know the approximate replacement of the disc pad.

The factors considered here are:
- Current Speed (CS)
- Reduced Speed After breaking (Crs)
- Time required for breaking with Front Break alone (T-fb)
- Time required for breaking with Front and Rear Break (T-frb)
- Factor (X) (To be identified by manufacture considering the Disc type)

Case: Only the Front Break is applied:

Assume the vehicle is running at 100 km/hr which is the current speed of the vehicle (Figure 4). Now due to front breaking alone the speed reduces to Y km/hr and the time required for breaking is Tfb. Now to calculate the degradation we can use the below formulae:

\[
\frac{(CS - Crs) \times Tfb}{X} = Z\%
\]

The calculated percentage gets added up by the controller when the breaking happens. The accumulated percentage nears 100%, an indication can be given to driver mentioning the disc is about to replace. The factor X should be determined by the manufacturer as the same varies with the make of the break pad.
Figure 4. Speed vs. time diagram.

**Case 2:** Front Break and Rear Break is applied:

Similar to factor X in the above scenario, factor Y needs to define when Front and Rear Break is applied. So when Front and Rear Break is applied in the above equation X would be replaced by Y. In case of Front being applied for some time and then combination of front and rear being used the equation would be as follows.

\[
\frac{(Cs - Crs) \times Tfb}{X} + \frac{(Cs - Crs) \times Tfrb}{Y} = Z\%
\]

### 3.2.4 Vehicle Service Reminder

The idea here is to remind the driver through dash board about the service due of the vehicle. During the servicing of the vehicle the engine oil would be changed. This system should detect the filling of engine oil through the flow meter and inform the microcontroller. The microcontroller then would set the time as zero and start counting. The time duration of the service is usually 3 months, the time is realized using real time clock. Logic explains the working,

- Identify the servicing when the engine oil is being changed. The changing of engine oil is captured through the flow sensor. The decision that engine oil is being changed is taken by microcontroller when engine oil flow is identified.
- Record the time from RTC and start the counting of 3 months.
- If three months is covered OR recommended distance is covered intimate owner.

### 4. Simulation and Results

The Figures 5 to 7 shows the hardware setup for the features mentioned in this work. Before going ahead with the hardware, the software was tested in the simulation environment and the results were observed.
Figure 7. Simulation result - rear break light.

5. Conclusion

By the implementation of these simple features to the two wheeler segment, the users mostly of middle-class income group are benefitted. But as mentioned earlier, this cannot be realized without the support of OEM’s as changes to the design of the vehicle is required. By introducing this feature the vehicles of the OEMs would have a selling advantage over the competitors. The next stage for these features would be to connect them to Internet of Things. Through this, the live Information would be available to the owner. This is an emerging trend and would soon reflect in our day today life.

6. References