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FABRICATION OF SMART HELMET LOCK SYSTEM INCLUDING SAFETY MEASURES

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Abstract--This paper focuses on implementing Microcontroller based "Smart locking system". Programmable Microcontrollers are used in order to perform required operation. The research survey includes the current technology/scenario of locking system. This helmet locking system is implemented to assure that the rider wears a helmet before rides the bike. Just in case the user takes out the helmet from the lock but doesn't wear it, the helmet is installed with two-step verification by implementing a limit switch in the helmet and communicate with the system wirelessly. It also assures that the bike speed doesn't cross athreshold limit and if at all the speed exceeds the pre-set limit there is an intimation and the rider is asked to slow down. Ultra-sonic sensor, limit switch sensor, speed sensor, rotary sensor and LCD are used as components. RF transmitter and RF Receiver are used for exchange of information. Carbon di oxide sensor is implemented to the exhaust which gives the percentage of the unburnt fuel. As a result, the bike ride becomes safer than before.
Keywords— smart lock, microcontroller, two-step verification, safety.

I. INTRODUCTION

Despite evidence that motorcycle helmets reduce morbidity and mortality, helmet laws and rates of helmet use vary by state. The main concern in this paper is to make riders wear helmets and increase the motorcyclist ride safety and also to make the carrying helmet easier than before. This lock system is in such a manner that until and unless the helmet is removed from the locker the ignition cannot be turned on. A smart helmet is a special idea which makes motorcycle riding safer than before. The main aim of the smart helmet is to prevent the biker from starting his bike until and unless he actually wears the helmet. Also in order to ensure if the helmet is worn after removing it from the lock, wireless switch is implemented in the helmet which indicates the validation signal. Thus resulting in more robust and safer system. One more major parameter for the safety is speed which is being continuously governed by speed sensor and a threshold speed is set. I.e. if the user exceeds the maximum speed it notifies the rider to slow down on the LCD display and also will beep for an alert which indicate to slow. And in case the rider refuses slow down the controller will turn of the motorcycle ignition hence, the rider either wears the helmet or will maintain safe speed on the motorcycle.

II. LITERATURE SURVEY

A similar proposed work that has been put forward earlier which is based on the principle of pressure sensing that is wearing a helmet creates a pressure on the helmet and a data signal is passed to the transmitter which redirects the bike ignition control to turn on. Moreover the transmitter and the receiver modules used are IR based. However, both the technologies have certain drawbacks. And online sources only provide information regarding the current available and executed project on smart helmet development and advancement in making helmet function as more different function that it is actually intended for.

Hence, developing the electronic locking system with the speed assisted tracking was a difficult challenge because of involving the lot of electrical and mechatronics in the development. By pooling data from eleven states: five with universal laws requiring all motorcyclists to wear a helmet, and six with partial laws requiring only a subset of motorcyclists to wear a helmet. Data were combined in the Crash Outcome Data Evaluation System's General Use Model and included motorcycle crash records probabilistically linked to emergency department and inpatient discharges for years 2005-2008. Medical outcomes were compared between partial and universal helmet law settings.

We estimated adjusted relative risks (RR) and 95 % confidence intervals (CIs) for head, facial, traumatic brain, and moderate to severe head/facial injuries associated with helmet use within each helmet law setting using generalized log-binomial regression. We estimated adjusted relative risks (RR) and 95 % confidence intervals (CIs) for head, facial, traumatic brain, and moderate to severe head/facial injuries associated with helmet use within each helmet law setting using generalized log-binomial regression. Reported helmet use was higher in universal law states (88 % vs. 42 %). Median charges, adjusted for inflation and differences in state-incomes, were higher in partial law states Injuries to the head and face, including traumatic brain injuries, were more common in partial law states. Road transport is essential for development as it provides mobility to people and goods. However, it also exposes people to the risk of road accidents, injuries and fatalities. Exposure to adverse traffic environment is high in India because of the unprecedented rate of motorization and growing urbanization fueled by high rate of economic growth. As a result, incidents of road accidents, traffic injuries and fatalities have remained unacceptably high in the India. Graphic presentation of the percentage share of different vehicle types in road accidents during 2017 is shown in figure 1

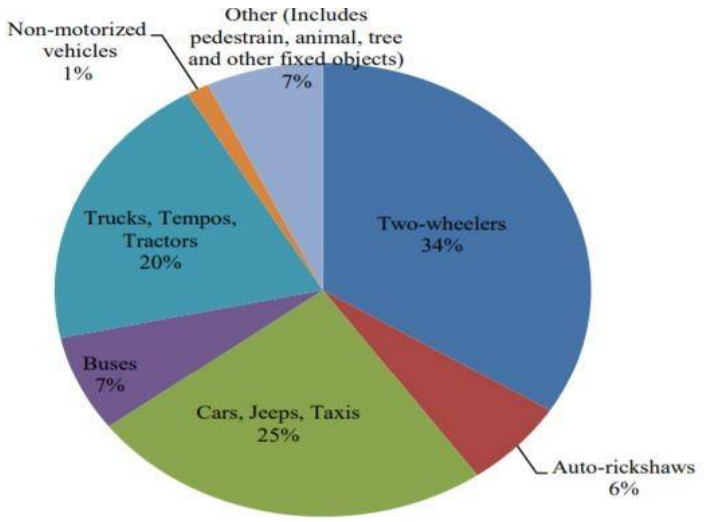

Figure 1: Various types of Vehicles met with Road Accidents

Two-wheeler accounted for the highest vehicle category-wise share in road accidents, but the category also dominates the composition of registered vehicles in the country. When the share of different vehicle category involved in accident are related to the respective shares in total registered vehicles, it becomes evident that it is, in fact, larger vehicles which are relatively more accident prone than two-wheelers.

- This figure 1 shows that the majority number of accident occur with two wheelers.
- The most dangerous mode of transportwill be with two wheelers.
- But two wheels being most cost effective and easiest way of transport but it is the one lacking the minimum safety on road now.
- The minimum safety can be full filled just by wearing the helmet.

PRESENT HELMET LOCKING SITUATION

There are various types of helmet locking system are available in the market at present. Some will lock it to handle, some will lock it to rear handle and some people prefer it to lock to crash guard with the help of wire lock. Some of them are shown in figure 2.

Figure 2: Different Types of Helmet Locking System

PROPOSED SYSTEM:

The idea of this work is that a biker must remove the helmet from the lock in order to start his bike, otherwise the bike won't start and will alert in the LCD display to wear helmet and a wireless communication is established between the helmet and the locker system so as to confirm if the user has worn the helmet after removal. This is satisfied by using the limit switch in the helmet which will sense whether the rider as wore helmet or not also in case of not wearing the helmet, the bike senses it. Hence the speed of the bike is limited to 40 KMPH, if the biker exceeds threshold speed. There is an intimation using buzzer which indicates over speeding. A fabrication of the locking system is considered with high priority of simple to use and automatic working and also secures enough to lock. The electronic locking is used in the system to have a closed loop feedback system and also will have automatic functioning which can't be satisfied with the mechanical locks. The modeling of the same is done in CATIA V5 mechanical design software. CATIA model is shown in figure 3.

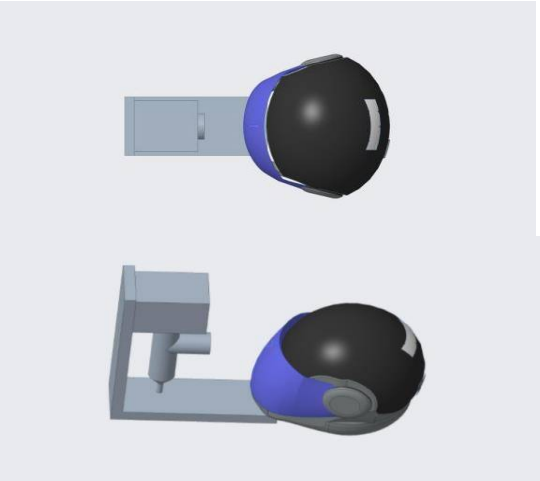

Figure 3: Modelling of the Helmet Locking System using CATIA V19

LOCKING SYSTEM DESIGN

The helmet acts as the second key to a biker. Besides, it also incorporates the advanced technologies of to ensure the rider rides at limited speed when not wearing the helmet and will always wear helmet when travelling at higher speed. The smart locking system will also make rider easier to carry the helmet and don't have to worry about the complex locking process to deal with, as every other rider does it now.
The smart helmet consists of four main modules:

1) Transmitter Module
2) Receiver Module
3) Helmet Sensing Module
4) Speed Sensing Module
5) LCD Module

Working of the Receiver is shown in figure 4 and figure 5.

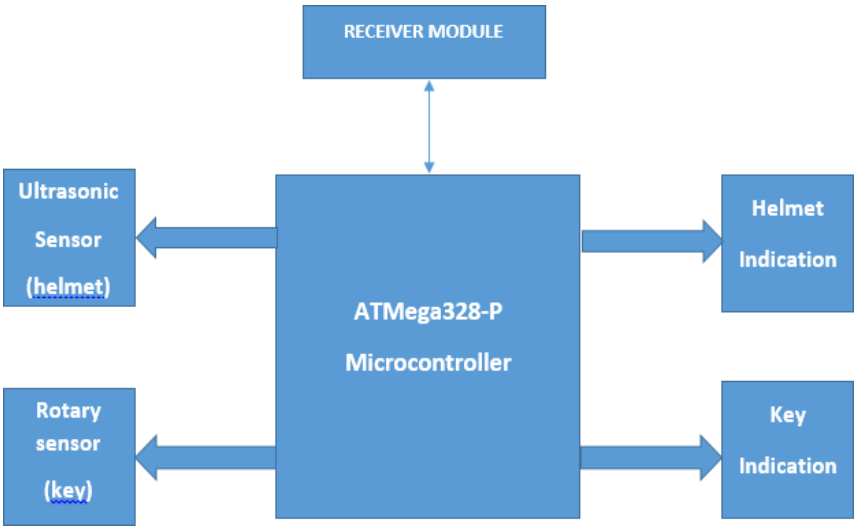

Figure 4: Block Diagram of a Receiver System.

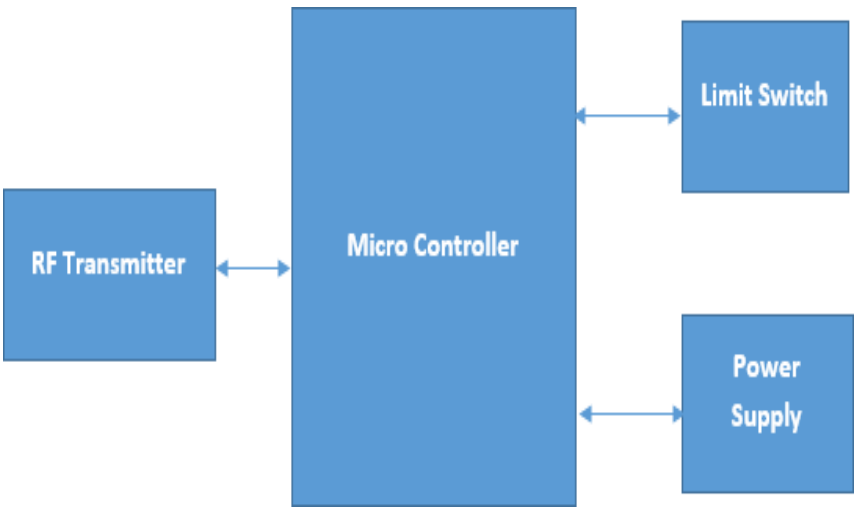

Figure 5: Block Diagram of a Transmitter System

METHODOLOGY AND IMPLEMENTATION

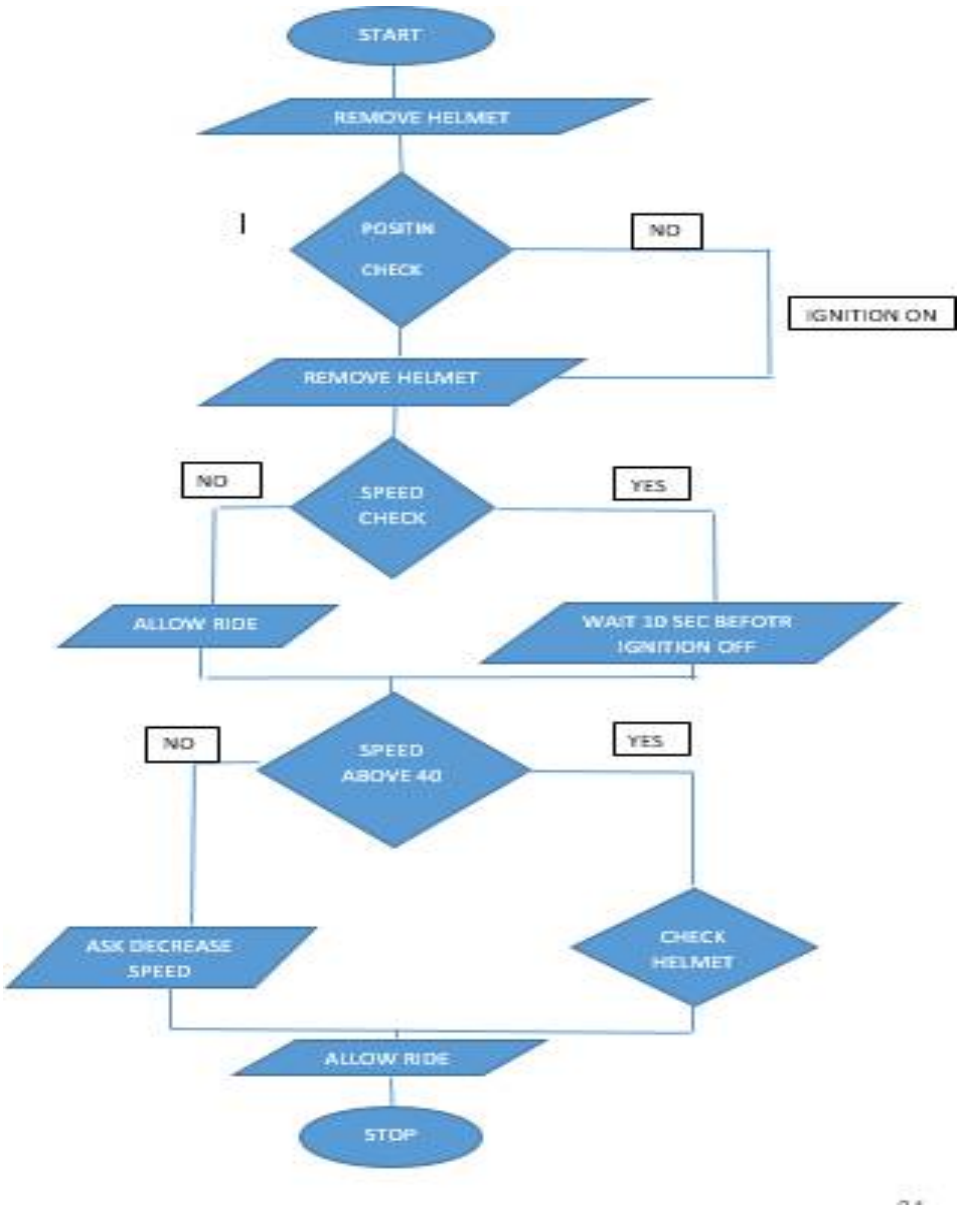

Figure 6: Flowchart of Working of Helmet Locking System

Sensors are connected to microcontroller which monitor the key and helmet state. When the user inserts a key, before switching the ignition on the system checks if the helmet is removed or not In case it remains in the same place the ignition fails to on, and it reminds the user to pick up the helmet If the speed is crossed above the threshold speed the system allows a certain time to wear the helmet (say 10 second) In case the riders fails to wear the helmet by then the engine is turned off. Either the rider has to wear helmet or decrease the speed of the bike. There is limit switch in the helmet which senses the pressure after wearing the helmet and transfers information wireless communicating modules. Once the wireless communicating modules confirms that the helmet is worn only then the speed of the vehicle can be increased above threshold. If the speed exceeds a Threshold speed without wearing helmet the user gets an intimation indicating to slow down the vehicle. There is also a carbon mono oxide sensor which gives the reading of the gas when the system is on. This is used to know the health of fuel burning which can be taken care in case of adulteration issues in fuel. The block diagram of the working of the helmet locking system is shown in figure 6. The photographs of the helmet after implementing the system is shown in figure 7(a) and 7 (b).

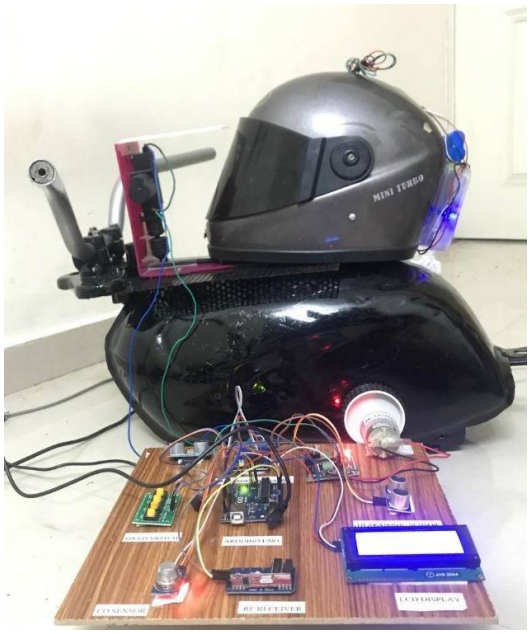

Figure 7 (a): Photographs of the Helmet after complete Installation

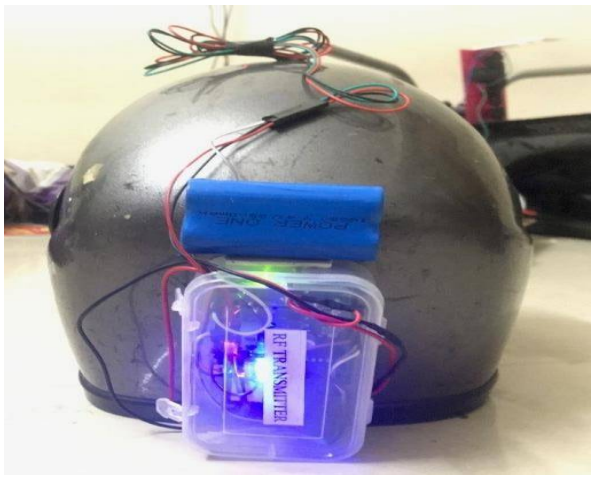

Figure 7 (b): Photographs of the Helmet after complete Installation

CONCLUSION

The main motive of this paper is to build the easy to lock helmet system and increase road safety for motorcyclist by developing the system integrated to motorcycle module and making the controller understand whether or not the rider is wearing a helmet and if the rider wears the helmet then the motorcycle will perform exactly as ridden by the rider and if the rider is not wearing the helmet the speed of the vehicle is restricted to 40 kmph and will beep if at reached at that speed and will hold for 10 second. If the speed is not reduced the controller will automatically turns of the ignition causing the vehicle to stop. And there is also informative LCD display reading out the speed and other rider instruction and also it reads out the carbon particle read out of the environment. If the carbon sensor is introduced in the vehicles exhaust system then it reads out the amount of carbon particle the vehicle releasing to the environment, which can be calibrated to know the engine health.

1. Easy installation to all bikes and other motorcycles.
2. Easy helmet storage with electronic locking.
3. More secure locking and automated locking process.
4. Zero maintenance after installation.

5. Increased rider safety and avoid head injuries mainly.
6. Reduced hustle to lock helmet and storing it at stops, which will increase the motive of the rider to wear and carry helmet.
7. Speed assistance according whether or not rider is wearing the helmet.
8. Speed limiting when the rider is not wearing the helmet, will increase the road safety and also rider safety and asking the rider to wear helmet to speed over the threshold speed.
9. Ignition controlled locking system will not allow the ignition until the helmet is removed from the locking holder which will make rider to remove the helmet from holder and wear the helmet.
10. The carbon sensor in the system will read out the carbon particle at that instinct moment.
11. In the case of mounting the carbon sensor at the exhaust. The sensor will read out the unburnt fuel releasing to the environment, which will also help to understand the engine health.

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