HI-TECH VEHICLE WITH SMART-TEC HELMET FOR BOTH RIDER AND PILLION USING IOT ENHANCING USER SITUATIONAL AWARENESS AND ACCIDENT REPORTING SYSTEM

PROJECT REFERENCE NUMBER: 39S_BE_2274

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KEYWORDS:
Rider and Pillion Helmet detection; Alcohol detection; Obstacle Detection;
Temperature detection; Accident detection; IoT; Vehicle Tracking, Monitoring and Controlling.

INTRODUCTION:
According to the U.S. Department of Transportation’s National Highway Traffic Safety Administration motorcyclists are 35 times more likely to experience a deadly accident on the road than those in passenger cars. When motorcycles crash, their riders lack the protection of an enclosed vehicle, so they’re more likely to be injured or killed. Thus this research mainly concentrates on the safety for two wheeler vehicles.

According to the Governor’s Highway Safety Administration (GHSA), wearing helmets is the single best way to prevent motorcycle accident fatalities. Wearing a motorcycle helmet can reduce the risk of death by almost 40% and the risk of severe injury by approximately 70%. In 2013 motorcycle helmets saved 1,630 lives. NHTSA says that if all motorcyclists had worn helmets, 715 more lives would have been saved. Thus this research involves the helmet detection module which determines whether the rider has worn helmet or not. If not, ignition of vehicle will not turn ON until rider wears the helmet.

Fig 1. Percent fatalities 2013
Drunken driving is one of the major causes of road accidents. Globally, some 480,000 deaths and 20 million of people get injured by drunken driving every year. Studies show that in low- and middle-income countries like India between 33% to 69% of fatally injured drivers and between 8% to 29% of nonfatal injured drivers had consumed alcohol before their crash. So step should be taken to avoid drunken driving cases. Thus this research involves alcohol detection module which determines whether the rider has consumed alcohol or not. If rider has consumed alcohol then ignition of vehicle will not turn ON and message consisting of rider’s location is delivered to the concerned person or cab services such as "U DRINK WE DRIVE" to take care of the rider who has consumed the alcohol.

Road safety experts have noted that the pillion is at greater risk of suffering serious head injuries in case of an accident. A general analysis of accident profiles of two-wheelers reveals that maximum hits on the bikes by heavy vehicles like trucks and buses (where risk of fatalities are higher) occur either from the side or behind, thus making the pillion more vulnerable to fall and prone to serious injuries. In study that was carried out in India on average 245 cases of motorcycle accidents in the year 2013, in which 23.67% of the bodies that were autopsied were of the pillion. According to NHTSA helmets are estimated to be 37 percent effective in preventing fatal injuries for motorcycle riders (operators) and 41 percent effective for motorcycle passengers. Thus it is very essential for pillion to wear helmet. This module is designed in such a way that pillion also has to compulsorily wear the helmet in order to turn ON the ignition.

The National Highway Traffic Safety Administration estimates that drowsy driving was responsible for 72,000 crashes, 44,000 injuries, and 800 deaths in 2013. Drowsiness—

1. Makes drivers less able to pay attention to the road.
2. Slows reaction time if you have to brake or steer suddenly.
3. Affects a driver's ability to make good decisions.

It is very necessary to prevent accidents due to drowsiness, thus we have introduced the obstacle detection module which detects, intimates and takes the necessary action during the critical situation. It is also seen that overheating of the engine due the continuous driving reduces the life cycle of the engine and also it is one of the major cause for the accident. Thus we have introduced the temperature detection module which detects and takes the necessary action whenever there is a rise in temperature of the engine. In spite of taking all the above mentioned precautions if there is an occurrence of the accident then the accident detection module is introduced in this research which helps in intimating the location of the accident to the concerned family person and the ambulance. This research introduces the antitheft protection for two wheeler vehicles and also provides vehicle tracking and monitoring using IoT technology.

**OBJECTIVES:**

An accident is a specific, unexpected, unusual and unintended external action which occurs in a particular time and place, with no apparent and deliberate cause but with marked effects. The main objective of this project is to control and avoid the causes which leads to accident such as

1. Making rider to wear the helmet compulsory.
2. To avoid accidents due to drink and drive cases.
3. Making pillion to wear the helmet compulsory.
4. To intimate the rider regarding obstacles and to maintain the safe distance between two vehicles (2 second rule) in order to control the vehicle during critical situation.
5. To warn the rider regarding the over-heating of the engine and controlling the speed of the vehicle in worst cases.
6. In spite of taking all precautions, if there is an occurrence of the accident then accident is detected when helmet hits the ground and message containing the location of accident is delivered to ambulance and concerned family person.

7. Tracking of vehicle and monitoring all the relevant information faced by the user along with controlling the ignition of vehicle from any corner of the world using IoT technology for antitheft purpose.

Thus our main objective is to make the pillion compulsory wear the helmet along with the rider as 30% of the pillion dies during the accident. Our objective is to save the rider’s life with simple but highly advance technology implemented in the vehicle which not only makes the user the efficient rider and reduces the accidents but also helps to save the user life during critical and unpredictable situations.

**METHODODOLOGY:**
Rider helmet  Pillion helmet
Bike module

Ignition locks or unlock through IoT:
Initially the bike module checks whether the authorized user has locked or unlocked the ignition of vehicle. When the authorized user has locked the ignition the Raspberry-pi extracts the data from the web server and passes over to the MC-1(Microcontroller at the bike module). The MC-1 then turns OFF the ignition of the vehicle and at the same time it sends the data packet to the MC-2 (Microcontroller at the rider’s helmet) through zigbee the MC-2 then activates corresponding channel of voice play back module and the rider will get the intimation “Warning message to rider- Vehicle is accessed by unauthorized user” through the speaker placed inside the rider’s helmet.

Rider helmet detection:
When the authorized user has unlocked the ignition of vehicle then the bike module checks the next condition that the rider is wearing the helmet or not. When the rider wears the helmet, the skin of the riders face touches the touch sensor and the output of the touch sensor will go high. The MC-2 then reads the output of the touch sensor and it passes the data packet to the MC-1 through zigbee and MC-1 makes the LCD to display “Please wear the rider helmet”. Next it checks whether rider is constantly wearing the helmet or not. When the rider is wearing the helmet, the output of the IR sensor will be high and it is read by MC-2

Alcohol detection:
The bike module next checks whether the rider has consumed the alcohol or not. If the rider has not consumed the alcohol, then the output of alcohol sensor which will be low is read by MC-2. The MC-2 then sends the packet of data to MC-1 through Zigbee.
If the rider has consumed the alcohol, the output of alcohol sensor will be high which is read by MC-2. It then sends the data packet to the MC-1 through zigbee and the MC-1 turns OFF the ignition of the vehicle and makes the LCD to display “Alcohol detected Engine turned off”. The MC-1 then sends the packet of data to MC-2 through zigbee. MC-2 then
activates the corresponding channel of the voice playback module and intimates the rider “Engine turned off due to consumption of alcohol by rider”.

The MC-1 activates the GPS module to detect the current location and send the message to the concerned family person or NGO or “U DRINK WE DRIVE” Services by using GSM with the help of AT commands. The MC-1 then writes the data to the Raspberry pi to update the information on the server.

**Pillion helmet detection:**

Next the module checks whether the pillion is present or not. The presence of pillion is determined by using the IR sensor at the footrest. The MC-1 reads the output of the IR sensor, if the pillion is not present, the output of IR sensor will be low. Hence MC-1 turns ON the ignition of the vehicle and makes the LCD to display “No pillion present Engine turned ON” and at the same time MC-1 sends the data packet to the MC-2 through zigbee which in turn activates the corresponding channel of the voice playback module and intimates the rider that “Pillion is not present engine turned on successfully”.

If the pillion is present the output of IR sensor placed at the footrest will go high and it is read by MC-1. If the pillion does not wear the helmet the MC-1 makes the ignition of the vehicle to remain off and makes the LCD to display “Kindly wear the pillion helmet”, and it sends the data packet to MC-2 through zigbee and it activates the corresponding channel of voice playback module and intimates the rider “Kindly wear the pillion helmet”. When the pillion wears the helmet the skin of the pillion’s face touches the touch sensor and output of the touch sensor goes high indicating pillion has worn helmet. Next the MC-3 (microcontroller placed on pillion’s helmet) checks whether the pillion is continuously wearing the helmet or not with the help of IR sensor. When the output of IR sensor goes high, it is read by MC-3 and it sends the data packet to the MC-1 through zigbee. The MC-1 then turns on the ignition of the vehicle successfully and makes the LCD to display “Pillion present-Engine turned on”.

**Obstacle detection:**

The vehicle continuously monitors the obstacle with the help of ultrasonic echo sensor while the rider is driving the vehicle. There will be 2 permissible limits (distance). when the rider approaches the 1st permissible limit the MC-1 makes the LED to display “Obstacle warning” and at the same time the MC-1 sends the data packet to MC-2 through Zigbee and MC-2 then activates the corresponding channel of voice playback module to intimate the rider that “ Kindly reduce the speed as vehicle crossed 1st permissible limit”. If the rider is alert, rider will reduce the vehicle speed to maintain the safe distance. But if the rider neglects the message and approaches very near to the obstacle i.e., maximum permissible limit, then the MC-1 reduces the speed of the vehicle to the certain limit by using PWM concept and at the same time it make the LCD to display “Obstacle detected”. The MC-1 then sends the data packet to MC-2 through zigbee and intimates the rider “Vehicle speed automatically reduced as vehicle approached very near to the obstacle”.

**Temperature detection:**

The module then checks the temperature of the engine by using LM-35 temperature sensor. If the temperature of the engine exceeds the threshold, the voltage of temperature sensor goes high and it is read by MC-1, then MC-1 reduces the speed of the vehicle gradually to zero and it makes the LCD to display “Engine overheat speed Dec to zero” and at the same time it sends the data packet to MC-2 through zigbee and MC-2 then activates the corresponding voice channel of the voice playback module and intimates the rider “Speed of vehicle gradually reducing to zero as engine is overheated”. The MC-1 then writes the data to the Raspberry pi which updates the information on the server.
Accident detection:

In spite of taking all the above mentioned precautions, if the rider meets with an accident the rider helmet hits the ground and vibration sensor will go high. The MC-2 reads the output of the vibration sensor and sends the data to the MC-1 through zigbee. The MC-1 makes the LCD to display – “Accident Detected”. The MC-1 then makes the GPS module to detect the current location and sends the message to the concerned family person or Ambulance by using GSM with the help of AT commands. The MC-1 then writes the data to the Raspberry pi to update the information on the server.

RESULTS AND CONCLUSIONS:

The proposed model of the project is shown in fig 2. The proposed module consist of rider helmet, pillion helmet and bike module. When the rider has not worn the helmet, ignition will remain OFF and the rider is intimated to wear the helmet through the message displayed on LCD. If the rider has consumed the alcohol then the module won’t allow the ignition of bike to turn ON and at the same time with the help of GPS the current location of the rider is determined and then by using GSM the message containing the current location is delivered to concerned family person or friends or “U DRINK WE DRIVE” services. If the pillion is not present and all the above mentioned conditions are satisfied then it finally allows the ignition of bike to turn ON. If the pillion is present then it will check the next condition that whether the pillion is wearing the helmet or not. Until the pillion wears the helmet the module won’t allow the ignition of bike to turn ON and it constantly intimates to wear the pillion helmet through speaker and LCD. When the rider crosses the 1st permissible limit then the message is sent to the rider through the speakers placed inside the helmet to reduce the speed as the vehicle is approaching near to obstacle. If the rider is alert, then rider will reduce the vehicle speed to maintain the safe distance. But if the rider neglects the message and approaches very near to the obstacle i.e. maximum permissible limit then the speed of the bike is automatically reduced to certain limit thereby helping to maintain the safe distance between the vehicles. If the engine is overheated the speed of bike automatically reduces gradually to zero and stops. The ignition of vehicle can only be turned ON again if the temperature of engine turns to normal. If the vehicle meets with an accident then the accident detection modules helps in determining the occurrence of accident and at the same time the message containing the current location of the vehicle is delivered to the concerned family person and ambulance.

Vehicle tracking, monitoring and controlling the system using IoT technology

1. The current location of the vehicle is tracked on Google Map.
2. Whether the rider has consumed the alcohol or not
3. Whether the engine is normal or overheated
4. Whether the vehicle has met with an accident or not

The ignition of vehicle can be locked and unlocked remotely. If the vehicle is accessed by the unauthorized user then the authorized person can remotely turn OFF the ignition of vehicle. This module also helps when the authorized user is not using the vehicle and by locking the ignition of vehicle remotely no other person can turn ON the vehicle even after inserting the appropriate key to turn ON the vehicle. This ensures the high end protection to the owner of the vehicle. All these parameters are provided in particular user account in website and android app is also provided to the user which makes the user convenient to monitor and control the vehicle.
**CONCLUSION:**

As per the notification issued by the Transport Department of Karnataka, "Every person while driving or riding (both for rider and pillion rider) a motorcycle of any type to motorcycles, scooters and mopeds irrespective of Brake Horsepower of the vehicle within the limit of Karnataka state shall wear protective headgear”. Hence this research helps to abide the rule issued by government to make the rider and pillion to compulsory wear the helmet and helps in avoiding the violation of the traffic rules, this in turn reduces the work of traffic police. The module also helps in providing the constant situational awareness to the rider and provides all the safety measurement to the individual during the adverse conditions to save his/her life using the helmet with simple but highly advanced technology which not only make the user the efficient rider and reduces the accidents but also saves the life during critical and unpredictable conditions.

**SCOPE FOR FUTURE WORK:**

1. Ensures the road safety by reducing the accidents due to drink and drive cases.
2. Reduces the work of traffic police.
3. Helps the rider to follow “TWO SECOND RULE” which is used to maintain the safe distance between vehicles.
4. This model also plays a vital role during the accidents by providing the fast medical aid to the victims.
5. This model also helps the NON GOVERNEMENTAL ORGANISATION(NGO) to initiate some programs for the drunken people such as “U DRINK, WE DRIVE” services.