



Design, Analysis & Prototyping KEAS: Advance Anti-Theft Security Keyless Ignition System for Two- Wheelers

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ABSTRACT

Vehicle safety and security has been a topic of great research over the years, due to the escalating vehicle theft cases reported all over the world. Traditional Lock and key has always been less reliable due to security concern. To overcome this problem, paper proposes a breakthrough advance ignition system which ensures twice the security by the integration of Hi-end technologies i.e. Wi-Fi and Near field communication. This amalgamation is achieved by the design and development of a system using microcontroller that can control the bike ignition. Moreover, to improve user interface proper smart phone application is developed through open-source platform. While there are theft alarm systems, remote keys available in the market for two wheelers. KEAS provide keyless ignition as well as alert through SMS in case of foreign disturbances and it enhance security. Automatic Side stand retriever system improves the safety of the rider. Furthermore, PUC sensors monitors pollution level according to government norms. Overall, the paper focuses on archetype and analysis of the 'KEAS' an innovative ignition locking system with advance technology. In future, developing the product by integrating Smart helmet and stationary fall alert. Thus providing better safety for two wheeler rider.

Keywords: *Wi-Fi, Near field communication, PUC, SMS, Remote key-less system*

1. INTRODUCTION

The paper intends to a dependable and full-bodied design of Keyless Ignition System with features augmenting the security of the vehicle. This system having various new features like an two wheeler can only be started when it detects unique Phone identity and fingerprint allocate to it and notifying owner by SMS about the theft attempt of the vehicle, allowing user to control the system totally by smartphone, tracing the location of two wheeler using GPS, Keyless Entry System for two wheeler and auto side stand retriever. The project is absolutely feasible under lethal condition and highly user friendly .This project uses mobile IMEI number(NFC enables card detection) as an authentication source to control ignition coil via means of android Application which securely establishes communication between smartphone and vehicle via Wi-Fi network using Wi-Fi module followed by an Arduino system which is further connected to ignition system and self-start button .This system works on the principle of IOT based ignition system which is the unique of its kind . To ensure system security the device identify IMEI & RFID code. Android device can access the ignition system of the motorcycle when the match situation occurs, the microcontroller ignites the engine otherwise it won't start. Redundancy is maintained to make the system reliable even in the worst case scenario. In the year 2015 the Indian express survey says that in New Delhi about 31114 two wheeler is stolen in which only 1542 vehicle is restored which is the matter of concern. Other global security system is much expensive for two wheeler when it comes to third party installation. This system is designed to be compatible with almost all the brands of two wheeler. This system is designed in such a way that it can also be started by self-start and also by kick start after the ignition is started by the key less entry system .This system is an innovative product for the market.



Usually while using key lock system for a long time and due to different climate conditions, erosion occurs in the locking system due to which the lock gets damaged and through any key the locking system can be unlocked.

2. LITERATURE REVIEW

- **A Survey on Keyless Security System for Two-Wheelers with Advance Automatic Features [1]**

Now a days usually to prevent theft Normal locks and wireless key, these are the two options available in the market. But they proposed a system which was designed such that there was no need of any lock. Their proposed Security System was totally based on the Password approach in which if password was correct then automatically got started and ready to drive but if password is incorrect then it was impossible to start motorcycle. This automated scheme was used by any motorcycle and provides ample incentive for petty thieves. With this tremendous increase in the number of vehicles on the road, there has been an increase in the number of crimes involving vehicle theft. In the capital city of Delhi alone there was a vehicle stolen every 36 minutes which amounts to around 40 thefts per day. At that time, the only type of safety product widely available for motorcycles are physical locks only such as padlock, wheel lock, chain lock and other physical lock, which tend to fail most of the time due to the fact that they are easily picked or broken.

- **Automobile Anti-theft System Based on GSM and GPS Module," Intelligent Networks and Intelligent Systems (ICINIS) [2]**

Proposed a stolen vehicle recovery system. The system ensured increased safety and credibility. It used ATMEGA 328 P micro controller. The vehicle owner gets the message regarding the vehicle location at specific intervals through GSM.

- **Vehicle location finder using global position system & global system for mobile [3]**

The hardware and software of the GPS and GSM network were developed. The proposed GPS and GSM based System has the two parts, first is a mobile unit and another is controlling station. In the study of vehicle location with GPS and GSM based system, it shows that the system is working but only a fraction shows the system's accuracy in an environment.

- **GSM based motor security system [4]**

The alarm system buzz sounds when the vehicle is tampered with and indicates that theft is in progress and it is also designed to stop engine if the position of sensor and key is not at the right place. The systems only unlock Engine function by sending sequence of instruction to controller via SMS thus the system is an immobilizer.

- **Tracking and Theft Prevention System for Two Wheeler Using Android [5]**

The security goals of the two wheeler can be achieved by the GSM and GPS technology. We can track and monitor the stolen vehicle through this technology. The two wheeler position is obtained by the GPS module, which is send to the microcontroller, which then sends the message to the user smart phone through the GSM module. In wireless data transporting, GSM and SMS technology is a common feature with all network service providers. Utilization of SMS technology has become popular because it is an inexpensive, convenient and accessible way of transferring and receiving data with high reliability.

- **Biometric Automobile Ignition Locking System [6]**

Automobile theft is the biggest problem in the remote location of the city and neither key lock nor Remote keyless system provides reliable solution because key can be copied very easily and remote keyless system encrypted data use radio waves which can be recorded and used to unlock the car. To design a unique key which doesn't rely on key or radio wave, biometric solution is the only better option. This paper introduces a biometric automobile ignition locking system using open source hardware and software tools. It consists of fingerprint module & Arduino hardware. This fingerprint module can be replaced by the fingerprint sensor of an android device and used as an authentication source for this project. The article provided by Delhi police does not give you effective guidance on antitheft, thus it is necessary to design a device that lock our automobile with unique key, a biometric locking system.



- **Auxiliary Safety Systems For Two Wheelers [7]**

This paper introduces Side stand retriever, smart helmet, PUC sensors to monitor the pollution caused by motorcycle.

- **Near Field Communication (NFC) Model For Arduino Uno Based Security Systems Office System [8]**

This paper presents the office security system for offices using near field communication (NFC) model which also can be used as a authentication source in keyless ignition system.

- **Survey On Automobile Theft [9]**

There is a good article written by Indian express about automobile theft in metro city like Delhi. In Delhi 2 case is registered in every 30 minutes. Software-Savvy, Tech-Friendly Thieves Armed with latest technology and tools, come in group of four or five, expert in every field on automobile engineering, they can find a way in. They don't require copying the ignition key as they use some Chinese software "the Engine Control Module (ECM) code breaker", available online and costs Rs 1 lakh.

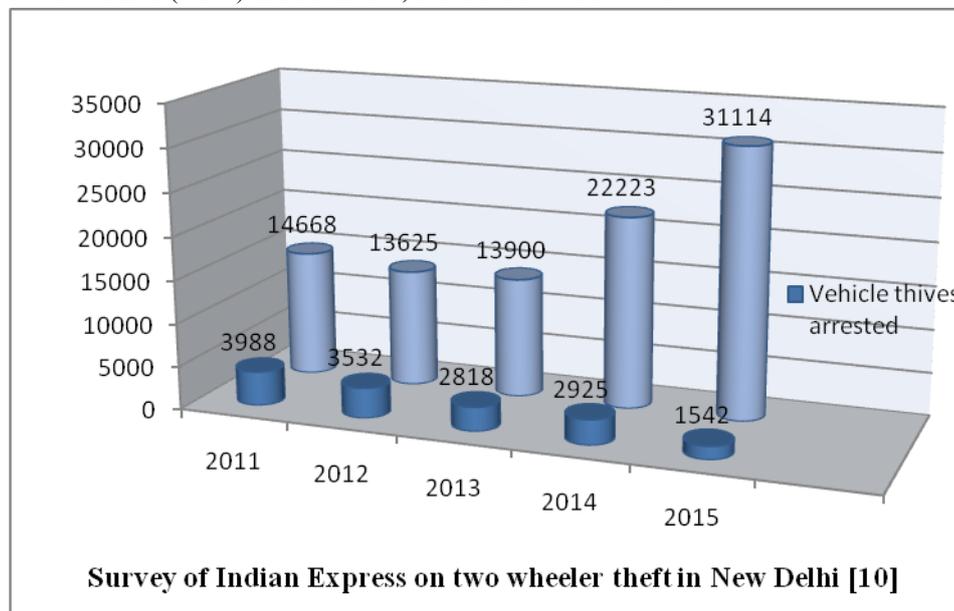


Fig 1: The case study on automobile theft by Indian express.

- **Capacitive Discharge Ignition for Two Wheelers [11]**

There are two common ignition types associated with classic bikes: contact points and fully electronic. For many years, the contact point ignition was the favoured system to control the timing of the ignition spark. However, as electronics, in general, became more reliable and less costly to produce, manufacturers turned to fully electronic systems—cutting out the mechanical contact points.

The contact point ignition system consists of:

- A battery or magneto to supply low voltage current for the spark
- Mechanical contact points to control the point of ignition
- A rotating cam to operate the contact points
- A condenser to reduce arcing across the contact point surfaces
- An ignition coil
- A spark plug

There are two main types of current supply for CDI systems, battery, and magneto. Regardless of the power supply system, the basic working principles are the same. Electrical power from the battery (for example)



charges a high voltage capacitor. When the power supply is interrupted, the capacitor discharges and sends the current to the ignition coil which then increases the voltage to one sufficient to jump the spark plug gap.

- **Components Used For Designing KEAS DEVICE**

Sr. No.	Components Used	Description
1	Wi-Fi Module	ESP8266
2	Arduino Uno	ATmega328P
3	Relay	4-Channel Relay interface board, 15-20mA DC, 12V and 5V input Voltage
4	Jump Wire	Simply wires that have connector pins at each end
5	RTD	Strain Gauge
6	Gear And Spring System	Auto side stand Retriever
7	PUC Sensor	MQ7
8	GPS Module	In-built in Mobile
9	NFC Module	PN532 ,In-built in Mobile
10	Fingerprint Sensor	In-built in Mobile

Table 1: List of Component

3. KEAS APPLICATION

The app will be designed such that for unlocking it, the fingerprint will be required. After unlocking the app the NFC reader will directly read the IMEI number and it will be verified by the Arduino board, after which the ignition will be started.



Fig 2: KEAS logo

4. METHODOLOGY

4.1. Mechanical System Design (Mechanical Design)

In hardware design, mechanical design is an important aspect to consider. In general, the Application needs to mechanical design, among others:

1. Design:

- Here, Housing is designed using the CATIA Software. The process of part design and assembly design is executed. Measurement for the housing is Optimized.

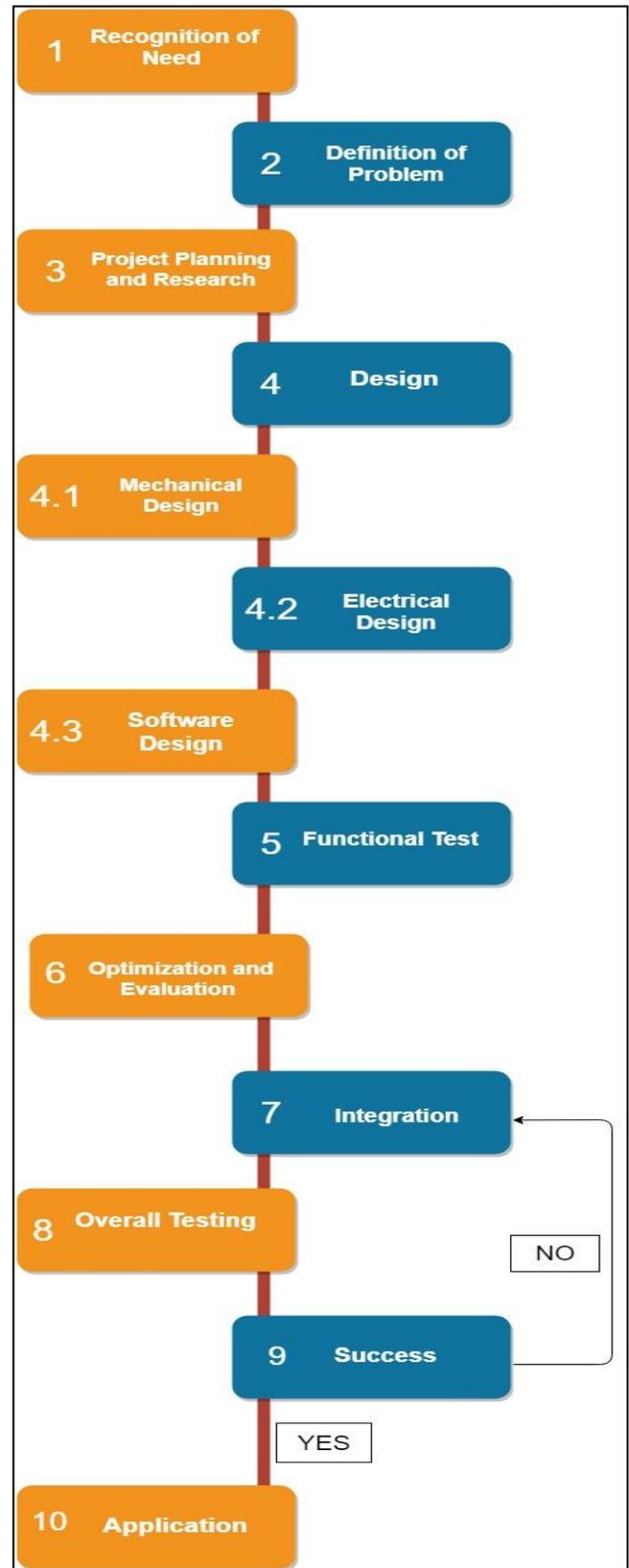


- Design of the holder for the smartphone in the two wheeler.
 - Design of side stand retriwer system.
 - RTD (Resistance Thermometer)
2. Placement of Components:
- **Arduino Uno:**
Measurement of the size and placement for the arduino Uno is determined in the housing.
 - **ESP-8266 Nod mcu WiFi Module:**
Measurement of the size and placement for the Module is determined in the housing.
 - **Relay:**
Measurement of the size and placement for Relay is determined in the housing.
 - **Housing:**
Position and area for the housing in the Two Wheeler is determined in this step.
 - **RFID Card:**
3. Testing of mechanical systems that have been Designed.

4.2. Electrical Circuit Design (Electric Design)

In the electrical design of the components there are several things that must must be considered, among others:

1. Power supply and power division for each Component:
Every component requires specific Power to run. In this step this requirement is fulfilled
2. Voltage and current requirements for microcontrollers, sensor and actuator:
 - Arduino Uno: 12V DC supply.
 - ESP-8266 Nod mcu WiFi Module: 5V DC supply.
 - Relay Board: 5V DC supply.
 - Sensor,Relay uses Micro controller for the voltage requirement.
3. Design of circuit sequence:
Integration of electronic modules to operate in the most efficient and appropriate way.The circuit is designed in this step.





4.3. Software Design

The design of the software programming to run the Micro-Controller is done in this step:

Fig 3: Flow chart

Arduino IDE: The Arduino integrated development environment is a cross-platform application that is written in the programming language Java. This will provide the connectivity between the arduino uno, WiFi Module, relays and sensors. The arduino uno and WiFi module is programmed separately.

Application Design: Application is designed using the MIT-App Inventor an open source platform for application design. Application lets user interface with the ignition system and other components. Proper design of the application improves the user interface design.

CATIA and AutoCAD: **CATIA®** is the world's engineering and design leading software used for product 3D CAD design excellence. Moreover, AutoCAD is used for 2D drafting. Here, these softwares are used for the design and analysis of housing for the electronic components and holder for the smartphone.

The following project is the integration of mechanical engineering, electrical engineering and computer science which drop this project under mechatronics. The casing design is done by CATIA and AutoCAD software which is the integration of mechanical engineering and computer science whereas Wi-Fi and Arduino programming is done by Arduino IDE software which is the integration of electrical engineering and computer science and ignition of the engine is the integration of mechanical engineering and electrical engineering.

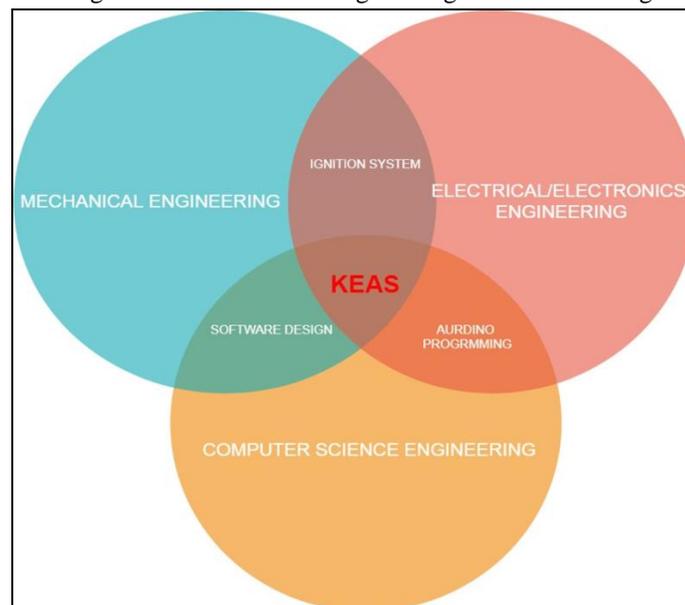


Fig 4: Vein_Diagram

The connection is done in such a way that no bypass of ignition system is there so no chances of two wheeler getting stolen. The casing is designed in such a way that it should be safe from the hazardous climate conditions. The casing is placed in such a way that it is safe from any external disturbances. The casing contains all the hardware from which the wireless ignition is operated.

The programming in the Wi-Fi module connects smart phone to the KEAS. Furthermore, the programming on Arduino authenticates the driver and the smart phone. Adding to this it controls relay and sensors. The whole hardware is seal packed in the casing to provide safety.

Besides this, the 2 relay is connected to the ignition system of the two wheeler. This completes the connection between the smart phone, electronic modules and two-wheeler for successful ignition wirelessly.



5. DEVELOPMENT OF KEAS



Fig 5: Assembly of KEAS

The following steps are involved to run this project safely.

- Step 1: •Opening the KEAS Application
- Step 2: •Tapping the smartphone NFC Reader to the specially designed Mobile holder having RFID card
- Step 3: •Ignition on notification.
- Step 4: •Tap self-start button to start the bike.
- Step 5: •To successfully lock the bike smartphones is tapped on the mobile holding device.

6. OBSERVATION

1. PUC Test Result of Yamaha FZ S V2.0 FI (15/03/19)

PETROL TEST			
	Pres STD	Measured Level	Unit
CO	3.5	02.162	% Vol
HC	4500	01215	PPM
CO ₂	--	04.44	% Vol
O ₂	--	14.60	PPM

Table 2: PUC report of Yamaha FZ S V2.0 FI

2. PUC Test Result of Hero Passion Pro (15/03/19)

PETROL TEST			
	Pres STD	Measured Level	Unit
CO	3.5	03.217	% Vol
HC	4500	00489	PPM
CO ₂	--	03.93	% Vol
O ₂	--	13.15	PPM

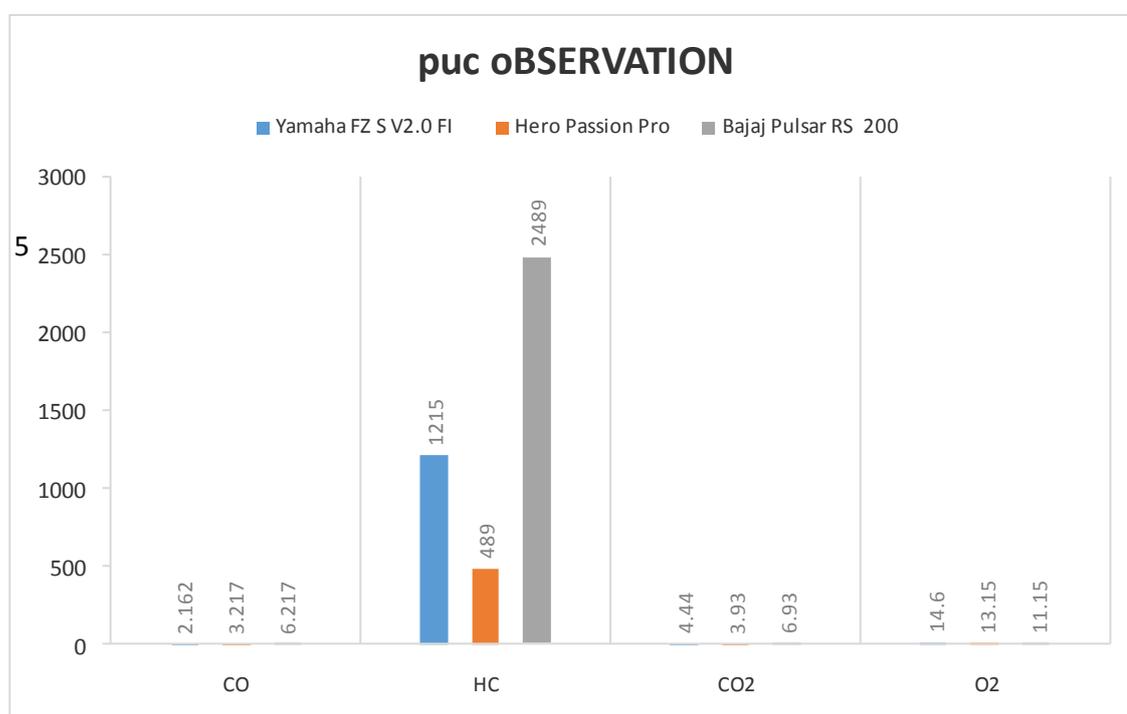


Table 3: PUC report of Hero Passion Pro

3. PUC Test Result of Bajaj Pulsar RS 200 (15/03/19)

PETROL TEST			
	Pres STD	Measured Level	Unit
CO	4.5	06.217	% Vol
HC	5000	02489	PPM
CO ₂	--	06.93	% Vol
O ₂	--	11.15	PPM

Table 4: PUC report of Bajaj Pulsar RS 200



X axis: Type of Gas

Y axis: % Volume/PPM

Graph PUC Observation

7. RESULT

In this project the integration of ignition system and electronic module by the use of optimized mechanical design is achieved successfully. It fulfills all the necessary safety features that verify the user and the smartphone by using unique IMEI number of the smartphone along with user fingerprint. The PUC sensor detects pollution level and displays on the smartphone. Moreover, RTD monitors the engine temperature and displays it on the smartphone. Side stand retriever system ensures safety of rider and helps the two to wheeler run smoothly with improved safety.

8. CONCLUSION

In this project we have our own security system with our own unique hardware, which also cannot be cracked by a thief easily. Input system using the latest technology that is near field communication (NFC) on android smartphone. The smartphone has KEAS application that verifies the RFID and IMEI number of the android device. Through the 2 step verification process it enhances the locking system of two wheeler such that only the registered user can start the ignition system. Through GPS with GSM for vehicle tracking and to send alert on



repetitive unauthorized unlocked request and are interfaced with the microcontroller and GPS device sends the value to the microcontroller frequently. The system output is switching on the ignition along with the self-start button and the motorcycle is ready to start. Through GSM the GPS will send the exact location to the owner through SMS. These days' vehicle robbery cases are higher than any other time, it has gotten to be fundamental to give a vehicle a superb security with the main solid hostile to burglary gadget.

9. FUTURE SCOPE

In this project by adding a pollution sensor to the vehicle tracking system it allows us to monitor the air pollution. By placing the project in automobiles we can maintain the statics of the pollution details, the owner can get the information about the vehicle pollution and can be controlled. Another feature that is to be added is auto stand retriever. The auto side stand retriever is the arrangement of gear and chain with side stand which ensure that the side stand should be at upward position during the movement of vehicle if the driver forget the push the side stand in upward position. The design is done in such a way that after side stand is returned to its upward position and there are no losses in the power transmission of the vehicle hence no friction losses occur in the vehicle.

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