Fig 9 shows the code of our substitution cipher.

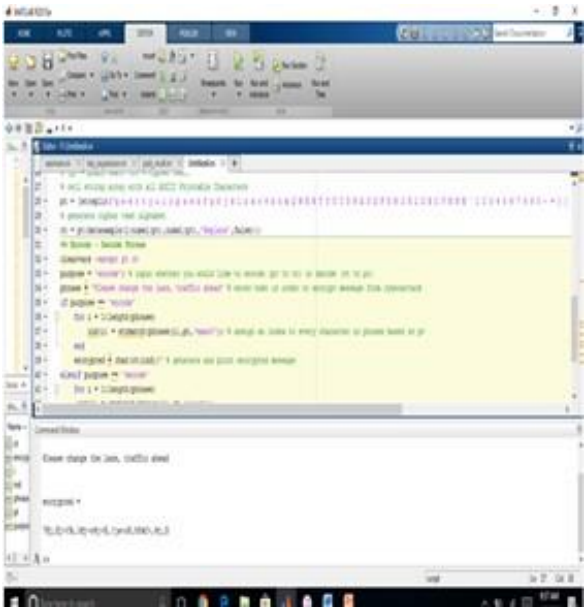
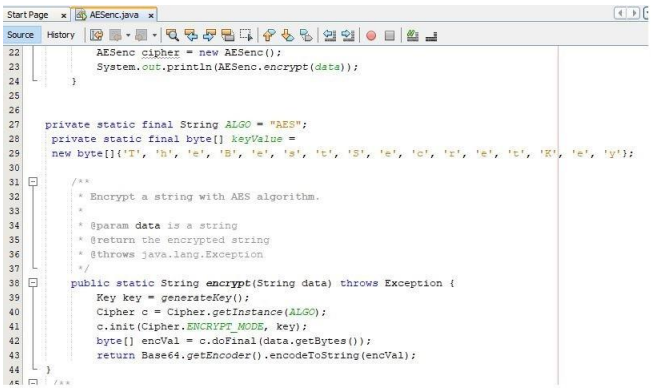


Fig. 9: Simulation of result on MATLAB

We used NetBeans to simulate the block cipher algorithm called AES-128. A message “Please change the lane, traffic ahead” will be encrypted by different round keys and XOR. AES-128 will create a threat free network by not only securing our information but also making it difficult for the attacker to decrypt the message. Fig 10 shows our encrypted message on net beans.

```
run:
Please change the lane, traffic ahead
VXPe+8wdpW8HC/+Emrc/moZAFEm+rrzenO8KpPPB6QbVdziEx/WvdN8OI/CVLd2b
BUILD SUCCESSFUL (total time: 14 seconds)
```

Fig. 10: Encrypted message



```
Start Page | AESenc.java
Source | History
            AESenc cipher = new AESenc();
            System.out.println(AESenc.encrypt(data));
        }

    private static final String ALGO = "AES";
     private static final byte[] keyValue =
     new byte[]{'T', 'h', 'e', 'B', 'e', 's', 't', 'S', 'e', 'c', 'r', 'e', 't', 'K', 'e', 'y'};

        /**
         * Encrypt a string with AES algorithm.
         *
         * @param data is a string
         * @return the encrypted string
         * @throws java.lang.Exception
         */
        public static String encrypt(String data) throws Exception {
            Key key = generateKey();
            Cipher c = Cipher.getInstance(ALGO);
            c.init(Cipher.ENCRYPT_MODE, key);
            byte[] encVal = c.doFinal(data.getBytes());
            return Base64.getEncoder().encodeToString(encVal);
        }
```

Fig. 11: Encrypted message

A base64 in our code will implement the encoding for both upper and lowercase letter. A secret key class represents the key providing independently. It is constructed through an array byte. Comparative to substitution method, our proposed algorithm stands out as a more secure one. During our implementation, the only drawback that we found was some delay in performance time of our proposed cryptographic algorithm. But a few seconds of delay can be compromised by the security of the network.

VI. Conclusion

In this paper we proposed the use of AES algorithm to secure the data theft and cyber attacks in the vehicles. The main idea of this solution is to implement a mechanism of message authentication using paired key values in the ECU which communicates with CAN protocol. Any harmful, hacked messages injected to an ECU or OBD-II port will be notified visually to the driver on the interface of the vehicle. This solution will help the driver recognize the attack and also take precautionary measures.

For future work, this solution can be used by the researchers for implementing this proposed model and test it according to the standards.

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