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Designing an Anti-Theft and Tracking System for Two Wheelers

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***Abstract:** In the automobile industry, security and theft prevention are a major concern. Bike thefts are increasing day by day. Many stolen bikes are used in illegal activities. This gave us a thought to think about a system which ensures our bike safety and security. The security goals are achieved by the GSM, GPS technology. When someone is trying to steal the vehicle, then the sensors detect it and intimates the owner through an SMS. This type of system is necessary in the two wheelers and the automobile industry must adapt and evolve in this area.*
***Keywords:** Security, Anti-theft, GPS, GSM, Smartphone.*

I. INTRODUCTION

This paper is about the implementation of the Anti-theft system for two wheelers. The system is capable of detecting sudden movement of the vehicle. Then the tracking system which is a miniature model of Global Positioning System (GPS) is used to find out the location of the vehicle around the world. GPS will be fixed in the vehicle to monitor the live position of the vehicle. With the help of the GPS value, we can calculate the distance with respect to time. The direction and the distance are fed into the microcontroller and the location information is transmitted through the GSM module by digital modulation. The receiver which is the user's smartphone will detect the signals and demodulate them and perform actions accordingly. This process is very fast so that the user is alerted on time and that can prevent the theft.

II. DESIGN METHODOLOGY

To implement a system, we need a proper approach on what processes and functions needed to take place to get the desired result. The following are the functions that needed to be performed for our system and we have to pick the hardware accordingly. We must also choose the components such that they are small and work accurately. A design can be realized after defining all the processes that will happen in our system.

A. Data Processing

In this project, we needed a medium to process the sensors data and respond to the data accordingly. So we have chosen Arduino Uno Atmega328p. Atmega328p has 14 digital input/output pins. The operating voltage of our Arduino uno is 5 V. It operates at a clock speed of 16 MHz with a flash memory of 32 KB. Bootloader uses 0.5 KB. SRAM uses 2KB and EEPROM uses 1KB. All the power supply to the components is directly given through Arduino. DC current for 3.3V pin is 50mA whereas DC current per I/O pin is 20mA. As the device is smaller, it fits perfectly to our project. It takes input from the vibration sensor and acts according to the commands given to it.

B. Vibration Sensing

In this project we use SW-420 Vibration sensor which is compatible with Arduino uno. Its operating voltage varies from 3.3V-5V. We want to sense the force of action which involves starting the two-wheeler. This sensor detects the amount of external force used to produce vibration. We will set a threshold limit for our vibration sensor such that if the amount of force exceeds the threshold limit, then it sends the data to the Arduino uno. Arduino receives this data and then implements a process to find the data of GPS coordinates of latitudes and longitudes.

C. Location Tracking

After receiving the data from the vibration sensor, Arduino uno acquires the GPS coordinates from the GPS module. We have used a NEO-6M GPS module, with 25x25x4 mm ceramic antenna. It is also installed with a dada backup battery. It has a baud rate of 9600. Our GPS module is continuously in touch with navigation satellites. So whenever it receives the command from Arduino, it sends the latitude and longitude coordinates to Arduino uno. We can set the GPS in such a way that it updates location coordinates to the Arduino every minute. Using that location coordinates we can locate the exact position of our vehicle.

D. Intimating

Now after receiving data from the GPS module, the Arduino has to activate the GSM module in order to send an intimation to our mobile. The module which we used is Sim900A GPRS A6 module Its working voltage is 3.3V to 4.2V. In order to activate our GSM module, we have to insert a working sim without any sim lock. After installing a sim card, it automatically connects to the network of the carrier. We use this module in order to send an intimation to the mobile phone. Whenever the Arduino gets the GPS coordinates, it sends an instruction to the GSM module to send the coordinates to the owner's mobile number, which we have set already. Now after receiving the commands from Arduino, the GSM module activates and sends the message within 10 seconds.

III. IMPLEMENTATION

A. Hardware Implementation

The network of components that we to implemented in our system is as follows:

1) *GSM Module:* GSM module is a hardware component that uses Global System for Mobile communications (GSM) mobile technology to provide cellular data to remote areas. A SIM is required to identify themselves to the network. This module typically provides TTL-level serial interface. In our project, we used the SIM900A GSM/GPRS module, used in many mobile phones. This module supports four frequencies, including 850, 900, 1800, 1900MHz. Working temperature of this module is -30 to +80 degree Celsius. This module supports voice calls as well as messages. Support maximum data rate, download 85.6Kbps, upload 42.8Kbps. Also supports standard GSM07.07,07.05 the AT command and expansion of Ai Thinker command. Its working voltage is 3.3 V to 4.2 V.

Fig. 1 GSM module

2) *SIM Card:* A SIM card is an integrated circuit that is designed to securely store the international mobile subscriber identity number, which are used to authenticate the subscribers on mobiles. A SIM card is mandatory in GSM devices. The SIM used in our project is a nano-sim. This card is inserted into our GSM module. Then our GSM module is connected to the carrier network and helps us to communicate.

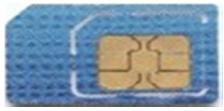

Fig. 2 SIM card

3) *Arduino UNO:* Arduino Uno is a microcontroller board, which consists of 14 digital i/o pins, 6 analog input pins, a USB connection, an ICSP header, a power jack and a reset button. These 14 pins can be used as input pins or output pins as per our requirement with the help of pinMode(), digitalWrite() and digitalRead() functions in Arduino programming.

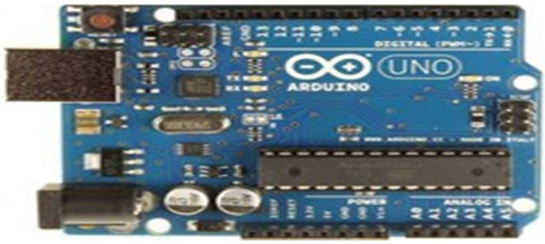

Fig. 3 Arduino UNO board

4) *Vibration Sensor:* In this project, vibration sensor SW-420 is used. This sensor creates logic states depending up on the vibration and external force applied. When there is no external force or vibration, then the module produces logic LOW output. Whenever we apply some external force or produce some vibration, then it produces logic HIGH output. The operating voltage of this sensor is 3.3V to 5V.

Fig. 4 Vibration sensor

5) *GPS Module:* The GPS module contains many tiny processors and antennas which directly receive data sent by many navigation satellites through dedicated RF frequencies. The GPS module that we have used in our project is NEO-6M GPS module. It can track up to 20 satellites on 50 channels and achieves the industry's highest level of sensitivity i.e., -161 dB tracking. The baud rate of this module is 9600 by default. Its operating voltage is 2.7V to 3.6V. An antenna is required for communication purposes, so it comes with a patch antenna having -161 dBm sensitivity. The NEO-6M GPS module has a total of 4 pins. They are Tx pin, Rx pin, Voltage pin and the ground pin.


Fig. 5 GPS module

All the above-mentioned components are used to shape our system and the result of hardware implementation is as follows

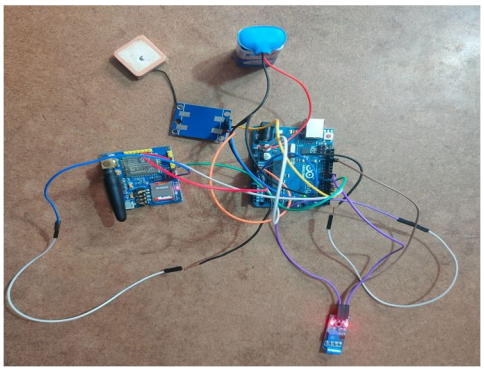
Fig. 6 Hardware System

B. Software Implementation

ARDUINO IDE is a software application for Arduino UNO and many other microcontrollers. ARDUINO IDE runs under Windows and IOS. ARDUINO IDE enables execution of ARDUINO programs. ARDUINO IDE incorporates a number of different libraries and several customizations. In our software implementation, we used different libraries such as GPRS_SIM900-master, GSM, GPRS, GPS, Shield_GSM, SHIE LD, TinyGPS++, Tiny GSM and we could achieve our software functionality through them. We have to write the code as per our functionality to get the desired results.


Fig. 7 Arduino IDE Interface

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Fig.8 Serial Monitor Executing AT commands

IV. RESULT

By implementing this system, we can ensure maximum safety to the vehicle and save the user from being robbed even if it has been stolen, we can track the updated location of our vehicle. The system sends an alert message along with the coordinates of our vehicle to our mobile. we can track the vehicle from the coordinates received from the gps module. The user will get a message like the message mentioned in below figure and this can be completely customizable as per the users choice.

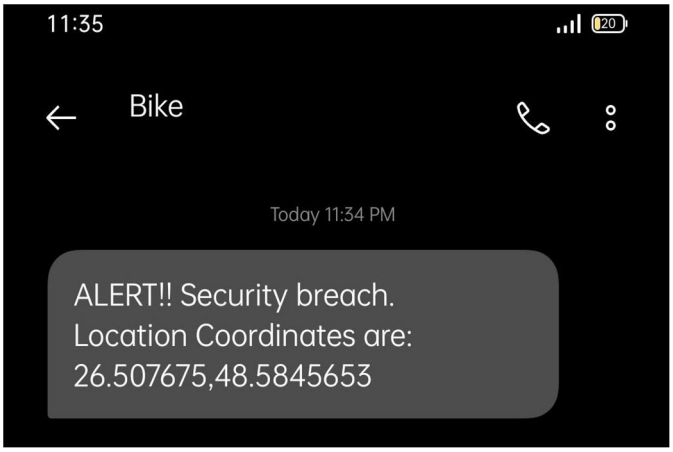

Fig. 9 Message received on smartphone

V. FUTURE ENHANCEMENTS

Vehicle theft and tracking are the fields in which the automobile industry must focus on. In our future enhancements we could use the battery that is present in the vehicle to power the system instead of an external battery. We can develop methods that could control the vehicle using the user's smartphone and can turn off the engine of the vehicle through the user's smartphone. We can modify the system to detect any accidents to vehicles and send the message to nearby hospitals and police stations, so that we can save lives.

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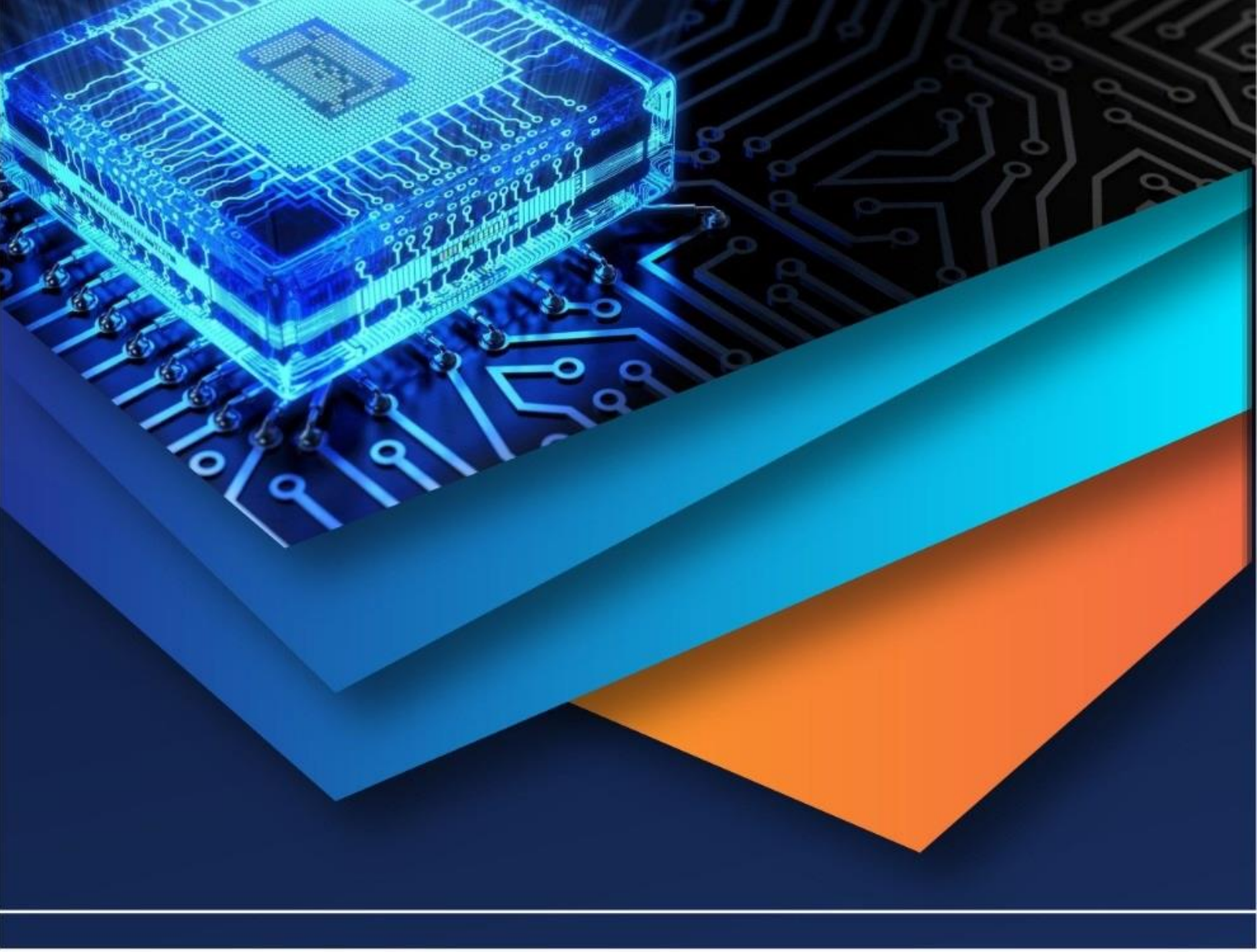

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