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A PROPOSED INTELLIGENT CAR TRUNK CRIME DETECTION SYSTEM: A CONCEPTUAL DESIGN

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ABSTRACT

With the increase in crime against humanity by some security operatives all over the world, the need to expand research on how to help in ensuring a decline in such activities has become important. Stop and search is a part of the duty of the police department, but in most counries, there are operatives that intentionally drop some illegal materials in the boot(s) of the victim in order to prosecute. This system has been proposed with the help of devices such as an LCD for capturing activities with the assistance of some sensors and camera which are coordinated by the micro-controller and an intranet for fast retrieval of information. The use of a smart phone which manages the system also coordinates with the GSM in the system to generate and sends SMS to a designated portal for proper investigation whenever a crime is committed. With the use of this system, any security operative having the intention of planting an object in any car boot is easily exposed by the system.

KEYWORDS: Car boot, Weight Sensor, Sound Sensor, Crime Detection.

INTRODUCTION

A Car Trunk is the opening behind the car created for storage or carriage of goods. The word trunk is used in North America, while boot is used in Britain.[1] To access the trunk or boot, it is important that the car will stop because the trunk is not accessed from within the car. This paper is to address a prevalent crime committed by security operatives and other agencies all over the world where, security operatives drop substances in the car trunk in order to accuse and extort the driver of the car.[2] This security system has become so important to be installed in all cars as the crime against humanity increases daily.[3] Designed and implemented a Car Anti-Theft System using Microcontroller gives the owner of the vehicle the rest of mind whenever the car is parked, which addresses the new ways of stealing Cars.[4] Designed a Car Theft control system for an automobile, is being used to prevent or control the theft. The developed system makes use of an embedded system based on GSM technology.[5] in an attempt to solving security issues proposed by the system with level authentication for the car users. This involves the use of biometric to enable the user ignite the car. It has a GSM system that sends the location to the appropriate quarters in an event of theft,[6] Designed an immobilizer security system using a PIR system to recognize the authentic user of the vehicle. Another level of security deals with the disruption of the engine where, the engine is turned off and on when the vehicle is used by an unauthorized person.[7] Basically, this system is proposed to make an entry into a database at time intervals which will be captured by sensors such as cameras, sound sensors and weight sensors. At any given time, a drop in the Car trunk is registered considering the time and the weight of the object and an image of the object. Most security system design has overlooked the aspect of this critical area. The principle point of this work is to outline and create a shrewd and strong crime detection and control framework for vehicles that can avert excesses from security operatives. The framework being produced through the present work utilizes GSM innovation and can be made low-cost, so it can be utilized as a part of vehicles. In section II, we present the block diagram of the proposed system which includes the Software consideration and the hardware setup. Section III includes working principles of the proposed components. Section IV, suggested the installation of the sensors for effective performance. Finally, the Conclusion and future focus is discussed in section V.

1. Hardware Diagram

The Hardware set up of the system entails: the sensors, the camera, the GSM, and the central coordinating micro-controller used to control the general system. The proposed hardware design is shown in Fig. 1.

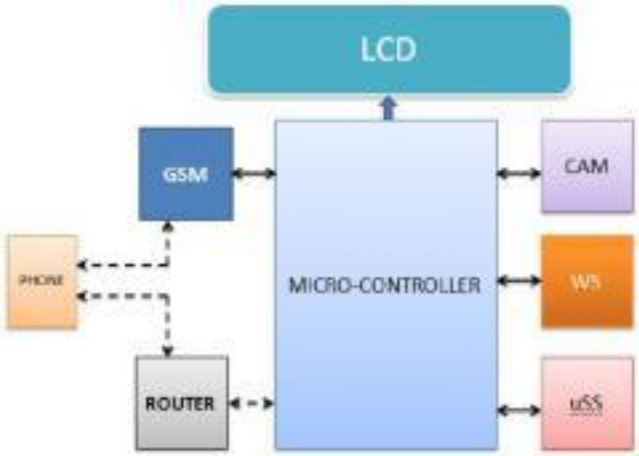

Figure 1: Proposed Hardware systems setup of the proposed system.

1.0.1 Micro-controller

The System Hardware comprises of the Micro-controller which is the center of the system controlling the other hardware components and the software. The Micro-controller can take inputs from the device they are controlling and retain control by sending the device signals to different parts of the system.

2.0. 2 Camera (CAM)

The camera takes photos of every movement and sends signal through the Micro-controller to database for storage. For effective event capturing, the system is built to have three cameras, each operating independently.

2.0. 3 Weight Sensor (WS)

The weight sensor senses a change in weight in the car trunk. The data is sent to the database and stored, which is used to determine the change of weight and the time of the change. The weight sensor is spread under a second base and the number of sensors is determined by the size of the trunk. The more sensors, the more sensitive the system becomes in capturing object drops.

2.0. 4 ultra Sound Sensor (uSS)

The sound sensor is a device that captured the sound difference and triggered alarm when the sound frequency as observed is different or more than the accepted frequency. This device is used to immediately report a drop of an object.

2.0. 5 GSM

A GSM modem is a wireless modem that works with a GSM wireless network which sends and receives data through radio waves. A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. The GSM modem requires a SIM card from a wireless carrier in order to operate. With the use of the GSM, a messaging module is triggered to send an immediate alert via a text message to the System Manager whenever a strange object is detected by the system.

2.0. 6 LCD

The screen is used to view the entire area of the boot; this is used to watch the boot when the driver of the car is not able to leave the driver's seat.

2.0. 7 Router

The router is used to enable system communication and interaction locally in the immediate environment where the system is installed. The router connected to the Arduino Ethernet Shield, enables the System Manager manages the system through the use of IP's, Wi-Fi and Ethernet cable.

2.1 Software Diagram

The Software basically is a collection of the programs designed to interface with the Hardware system in order to control the entire system. The basic proposed software considered are; the database back-end, the system manager application and the firmware for the micro-controller. The system is proposed to store and retrieve data using both cloud and local database. Fig. 2 shows the intercommunication of the software system.

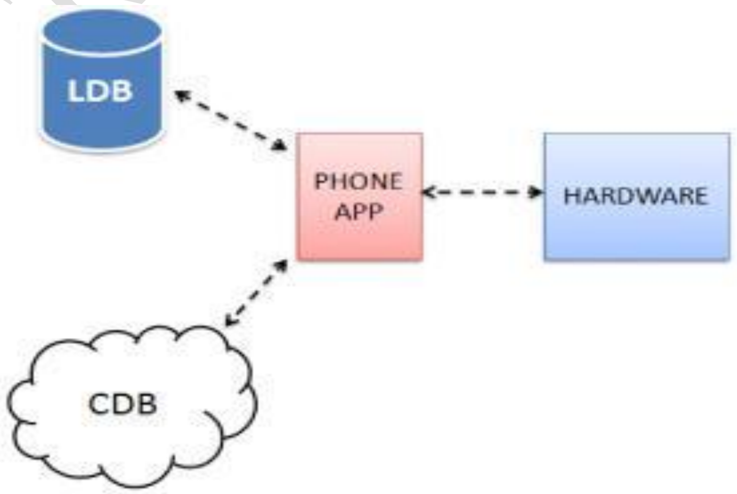

Figure 2: Proposed Software applications of the proposed system.

2.1.1 System Manager(SM)

The SM is a software application with the ability to send, retrieve and store information in the system. It is made of the video player (VP), a live weight display screen (WDS), a sensor triggered indicator (STI) and database management tools. Fig.3 shows the proposed design of the app. The SM has three different viewers: the uSS viewer (uSSV), the weight viewer (WV), and the camera viewer (CV). The LCD screen is used to view live events as triggered by the MIC through the GSM. The CV is used to view saved images either from the LDB or the CDB when needed. It carries the date, location and time of every saved event for record purposes. The uSSV displays the different sound frequency when a frequency different from the default frequency is observed. This sends signals through the GSM after the observed difference is processed, calculated and confirmed.

2.1.2 Local Database (LDB)

The LDB is designed to hold data collected from the system at every instance. Several options available are: online database, which uses online database design and management tools and offline database stored in the memory card of the AES. For the purpose of this work and the critical nature of the system, the both will be deployed in order to maintain and ensure data availability, security and integrity. The online database is used to basically store data in the cloud while the offline database is deployed locally to enable quick access to information.

2.1.3 Cloud Database (CDB)

The CDB is designed to store critical data and information for safe keeping. In the event of any damage of devices at the scene of any crime, every data stored is able to be retrieved from the cloud for defense reasons. Several other services can be adopted.

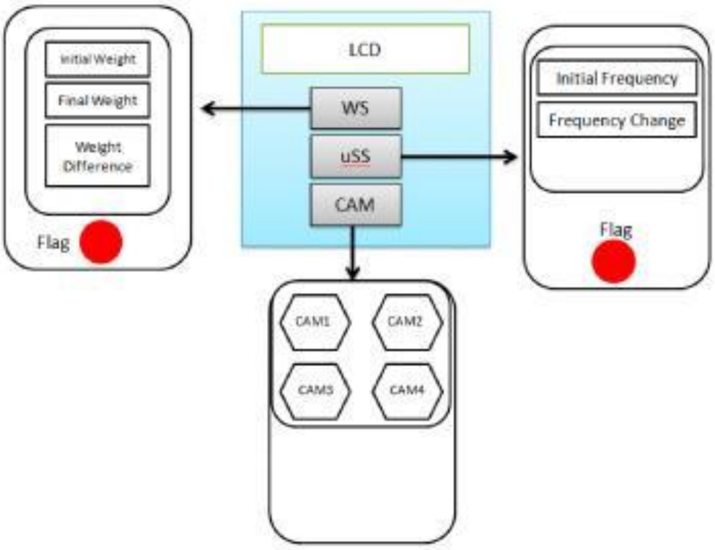

Figure 3: General System Manager App showing the different interfaces to view events both from the LDB and the CDB.

2 System Operation

The system operates automatically depending on the logic combination between the "the driver on seat" and "the boot (trunk) open" events. If the two are true, then the system is activated for data capturing and storing. Fig. 3 shows the signal flow diagram of the system. The Weight sensor initializes itself by calculating and storing the initial average weight in the boot as stated in Eq. (1)

$W_{(T)} = (\sum_{i=1}^{n} W_i)/N$	(1)
$F_D = F_O - F_I$	(2)

In Eq (1), W_T is the average weight of the N number of Weight sensors, which must be greater than w and F_D is expected to be greater than F_I before the GSM sends a Flag to the SM for the indicator on the uSSV and WV `to be read. The signal is presented as shown below and as explained above.

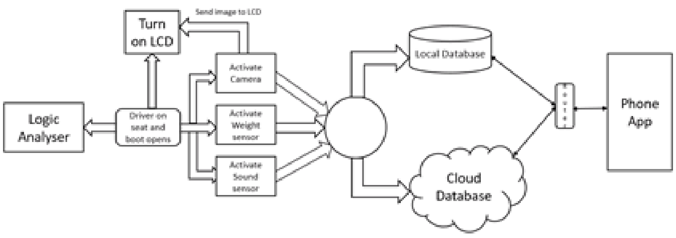

Figure 4: General signal flow diagram when the system is activated for data capture and information storage.

3.1 System Algorithm

In Fig.5, the system flowcharts showing the signal flow and control as presented from the logic analyzer to the GSM triggered events. This further explains the activities in Fig. 4.

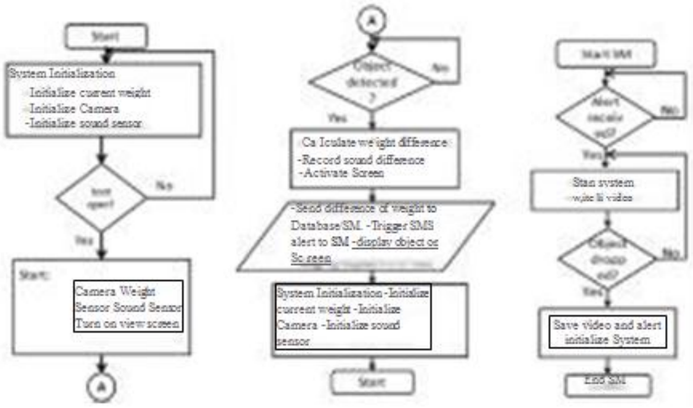

Figure 5: System flowchart A. Based on the logic analyzer system.

4. Systems Proposed Installation

This session shows the proposed system installation. It proposed the positions of the WS, uSS, and the CAM. The positions and the number of sensors is subject to the size and nature of the boot. The bigger the boot, the more sensors needed to cover the entire boot, for accurate and efficient data capture.

The cameras are located at strategic points in order to see all the possible angles the security agent would drop the object. In Fig. 6, the cameras are positioned on the north, west, east and south of the boot for full coverage of the entire boot. The weight senor(s) is (are) also installed at between the base and a weight (pseudo-base) base, making the entire base to lie sensitive to the up to O.Olg. The smallest weight dropped is captured and calculated. The sound sensor is also installed in the pseudo-base, to detect a drop sound by any person trying to drop an object.

(a) (b)

Figure 6: System installation showing (a) as the placement of the WS between the

Weight base and the main floor of the boot, while (b) shows the camera installation round the boot, where all four cameras are programmed to capture every move within the boot.

Figure 7: General System installation show positions of sensors for efficient data capture.

CONCLUSION

In this proposed system, the different parts are not specified; this is to give room for adequate testing and evaluation before adopting the most effective among many. From existing system, it is clear that putting the right parts as discussed in the body of the paper is most likely to generate the desired result in the communication between the software setup and the proposed hardware connectivity. The future work is to do a simulation of the proposed system with available and appropriate simulation software. Finally, a real time system will be built. With the completion of the implementation of this system, a driver of any car can at all times see in real time what happens in the boot whenever security operatives stops the car for search.

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