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Miniature Prototype of Car Automation and Security Using Arduino

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ABSTRACT: With an ever-increasing number of individuals adopting open-source hardware and software devices, Arduino has given rise to a new dimension. Arduino is a microcontroller that can be connect with various sensors and actuators along with other third-party applications. The hardware components of Arduino are less expensive. The various kinds of sensors that can be integrated with Arduino include infrared sensors, ultrasonic sensors, distance sensors, etc. For actuators we have motors, GSM, GPS modules, etc. This paper gives an overview of how Arduino can be integrated with other components with respect to a realworld scenario – Collision Avoidance System in driverless and Human-driven Cars using Arduino.

KEYWORDS: Arduino, Sensors, Actuators

I. INTRODUCTION

In today's world, with increased urbanization comes certain problems. Increased urbanization has increased traffic congestion and accidents. With the increase in vehicles comes the importance of safety. The modern world is taken over by technology that has improved the security and safety of our life.

Most of the individuals have their own vehicles and one of the major problems they encounter is to find a n appropriate parking space. Fishing for a parking space is a task which in turn creates traffic congestion. This increased traffic congestion and uncertainty in the availability of parking space demands the need for a smart parking system. This system will prevent the user from wasting time looking for a parking space in a public area.

It is important for autonomous and human-driven cars to ensure the safety of the vehicle and the surrounding vehicles and people. Engineers are continually grappling with the issue of automotive safety. Collision in a car could be caused by a number of circumstances that includes poor road conditions, excessive speeding, erroneous traffic, etc. Automobiles these days are becoming smarter, giving rise to autonomous vehicles, thus reducing human intervention. Self-driving cars are gaining popularity as they are famous not only due to the features provided by them but also the advantages that comes along.

In today's world, safe and collision-free travel is critical. Traffic accidents claim the lives of about 1 million people annually, with humans accounting for the majority of these fatalities. Collision avoidance technologies have just begun to appear, especially in self-driving cars with the caveat that they must avoid colliding with objects. Collision avoidance is a critical issue for the transportation industry. The primary goal of the system is to prevent two or more objects from colliding what steps to take to prevent them.

Also, there are many cases where it is not possible to prevent the accidents but it is possible to ensure the safety of victims. Since many accidents go unreported therefore this project provides a solution to such cases where the victims family and officials get information and are aware about the accident so necessary action can be taken immediately.

Another issue that comes with increasing urbanization is securing the vehicle if it is parked in an unauthorized car parking area. Many a times, it so happens that user parks their car in an unauthorized car parking area. In a situation where the vehicle is being towed, the user will be informed about this using this system.

The user requirements from this project are:

- 1. Optimized parking, i.e., users would save time, resources and efforts. By commercial means the parking space can be utilized efficiently.
- 2. Enhance safety of the driver and the vehicle by avoiding the collision of car.
- 3. In case accident is detected, no cases would go unreported and speedy investigation Would take place. The user gets the benefit of medical assistance as soon as possible.



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4. Being concerned with the safety of the vehicle, the system avails the feature of messaging the user if his vehicle is being towed.

Therefore, being concerned with the safety and security of the users and vehicle, the implementation helps in upgrading the features of existing vehicle.

II. BACKGROUND

The paper focuses on building a prototype of 4 modules listed below:

- 1. Collision Avoidance System
 - With the increase in vehicles comes the importance of safety. Most of the accidents take place due to collision with other systems. So, to overcome this, a collision avoidance system is used. Collision Avoidance System can be termed as an accident prevention system that will alert the driver if he is going to collide into any object. The main objective of the system is to ensure the safety of the driver by keeping him alert. The system consists of buzzers and LEDs which are used to provide warning signals. These warning signals will help in keeping the driver alert hence keeping him and the surrounding objects safe.
- 2. Accident Detection System The main purpose of this module is to detect an accident immediately after it has occurred and inform the family members of the victim. The system makes use of accelerometer, GSM and GPS modules. Therefore, it aims at saving the precious life and not lead to death by injury.
- 3. Smart Car Parking System

Increasing urbanization has increased the number of vehicles. In public places, there are many slots/lanes available for parking which involves a lot of manual labor and investment. The need arises to develop a system which will inform the availability of parking space at the entrance itself. The main objective is to provide an organized way of parking which will benefit the users. In the proposed system, we use infrared sensors to detect the presence of a vehicle within a parking slot and LEDs to inform the user about empty slots.

4. Unauthorized Parking Detector In many instances, cars are parked in an unauthorized location. In such cases, if the vehicle is being towed, the user is alerted with an SMS. Normally, the user is not notified for a long time after the vehicle has been towed. This could potentially result in them paying additional fees. With this module the user receives a tow alert.

III. SYSTEM INTRODUCTION

a. Collision Avoidance System



Collision Avoidance System consists of an Ultrasonic sensor, LEDs and buzzer. Ultrasonic sensor has 2 components

- 1. Ultrasonic transmitter which transmits electronic waves in air and when it gets objected by any material, it gets reflected back.
- 2. Ultrasonic receiver that receives the signal and calculates the distance using the speed of light in air.



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Ultrasonic sensor is used to measure the distance of car from other objects/vehicles. Depending on the distance we can define 3 zones:

- 1. Zone 1: Safe zone
- 2. Visual warning LEDs light up
- 3. Zone 3: Both visual and audio warning (LED lights up and buzzer will buzz)

Ultrasonic sensor is used to detect the presence of another vehicle or object and the distance from the vehicle. LEDs are used to provide a visual warning to the driver and buzzer is used to provide an audio warning to the driver.

Collision Avoidance System in Driverless Cars

The concept of Driverless, automatic has come into picture due to the evolution of digitization. The characteristics of a driverless include obstacle recognition, auto-braking control, location tracking, etc. The focus will be on three primary features – operating in line with the environment, detecting obstacles and making appropriate decisions.

Self-driving cars have a cut above human-driven cars as they are completely automatic and there are no distractions that could affect the vehicle. This paper presents a functional small prototype of self-driving automobile that makes use of Arduino. The methodology used here is Controller Area Network(CAN) that offers numerous benefits and is used in manufacturing, aviation, etc.

Controller Area Network is a message-based protocol that is used by microcontroller to communicate with each other without the use of a host system. CAN follows the standards of 22898 that specifies how communication occurs through the exchange of messages. CAN has nodes which can be a sensor or a microcontroller that communicate with each other. Once a message is sent, it is received by all the notes in the network.

An environment driven by internet makes use of several communication protocols that differ from each other. CAN Physical Layer transports data between notes and it determines the mode in which signal is transmitted.

The Self-driving vehicle makes use of an ultrasonic sensor that detects the presence of a vehicle within a proximity of 20cm. This is followed by the transmission of message frames that are captured by the controller. The protocol code is picked up by the controller that in turn controls the movement of the vehicle, thereby avoiding a collision.

b. Accident Detection System



In this module, we use an accelerometer, GPS and GSM module. whenever a vehicle meets with an accident, the accelerometer sensor will detect the significant change in any of the 3 axes and send it to Arduino. The GPS module gets activated and the coordinates of the location are collected. This also activates the GSM module and a message consisting the location co-ordinates is sent via an SMS to a trusted member.

Accelerometer detects the tilt in the vehicle. GPS detects the location of the vehicle and GSM sends a message to the registered number.

c. Smart Parking System

The system makes use of an Infrared Sensor which is installed in every parking slot. This sensor detects the presence of a vehicle. There are 2 LEDs at the entrance corresponding to every slot. If the IR sensor in a slot detects a vehicle, the corresponding red LED will glow indicating that the slot is filled. On the other hand, if the slot is vacant, the corresponding green LEDs will glow. The Arduino board acts as the main controlling unit. It takes values from IR sensor and supplies power to the corresponding LED.



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d. Unauthorized Car Parking System



Arduino is the main controlling unit. Tilt sensors are used to detect the inclination. If the vehicle is being towed and taken away, tilt sensors will be activated which will trigger the Arduino UNO. This will activate the GSM module and a message will be sent to the owner saying vehicle has been towed.

IV. IMPLEMENTATION OF THE SYSTEM

1) Smart Car Parking System

a) The car parking slot is occupied

The red led glows which shows the presence of a car in the slot.



b) The car parking slot is empty The green led glows which indicate the slot is empty.



2)Collision Avoidance System

a) The proximity of the object is between 20 and 50 cm. Blue led glows which will alert the user.



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b) The proximity of the object is less than 20 cm.

The red led glows along with the buzzer buzzing to alert the user.



3) Accident Detection System



4) Unauthorized Car Parking System



V. CONCLUSION

We have discussed about 4 modules that help us achieve automation and security respectively. When it comes to automation, we can see how the collision avoidance system is used in an automated, driverless car. At the same time, security is achieved through the accident detection, unauthorized car parking modules. Smart Car Parking system is a module that helps us achieve a part of automation, as it reduces the need of manual efforts at a car parking area.

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