International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 09 | Sep 2021 www.irjet.net p-ISSN: 2395-0072

Fabrication and Implementation of Autonomous Vehicle Directional Indicator System

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Abstract - *Since their creation, automobiles have undergone a radical transformation. In the car industry, the importance of safety and comfort is increasing. Automobile safety and comfort are one of the most important issues. There is also a vehicle directional indication to improve the safety and awareness of all road users, including drivers, pedestrians, and bicyclists alike. It is possible to provide electricity to either the left turn signal light or the right turn signal light based on where the directional indication is located on a driver or autonomous vehicle. However, most drivers do not utilize the directional indicators anymore. Human error might be reduced by replacing the standard indication system with an autonomous directional indicator system, which would eliminate human error. Here, we utilized Proteus software to simulate the circuit and ensure that our circuit designs were feasible and workable. As a result, this technique lowers driver mistakes and improves passenger and driver safety.*

Key Words: *safety, directional indicators, driver error, accidents*

1. INTRODUCTION

In this research, the lights and signaling devices are installed on the vehicle's front and back. These lights are used to alert other drivers and pedestrians of the vehicle's direction of travel, speed, or position. These lighting solutions improve the safety and awareness of everyone who uses the roads.

1.1 Background Information

This rapid growth in the car population can be attributed to a growing need for quicker and safer transportation methods. Automobile manufacturers have been forced to enhance safety measures because of this increase in accidents on the road. A driver's mistake is responsible for the majority of traffic accidents. A growing number of automakers are striving to automate as many systems as possible so that the number of road accidents caused by human mistakes can be reduced. Similarly, our initiative aims to make the vehicle's indication system function on its own. Due to its cost-effectiveness, we utilize the microcontroller and mobile GPS. To test the system's functionality, the basic circuit designs are created and simulated using PROTEUS software.

1.2 Statement of Problem

The problem statement in this work is the road accidents that were happening because of not using the directional indicators or turn signals in automobiles. The purpose of this project is to make the vehicle directional indicator work autonomously so we could prevent accidents even if humans fail to operate it.

2. LITERATURE REVIEW

The vehicle lighting system consists of three main components they are Headlamp system, Brake light system, and directional indicator system[1]. These three systems are considered to be the most important systems of automobiles since they serve as lifesavers on many occasions.

The headlamps are placed in the front side of the vehicle and in early days the headlamps are powered using dynamos placed in the motorcycles but nowadays it is powered using the vehicle battery. It is used to light up the vehicle while traveling in the dark. The vehicle brake light system is used to indicate the sudden deceleration or stopping of the vehicle. The brake lights are red as they have a longer wavelength as it stands last in VIBGYOR pattern[2].

The indicator lights are placed both on the front and rear side of the vehicle and it has two bulbs one at right and another at left to indicate the left and right movement of the vehicle respectively. The driver has to power the indicator light by actuating the switch which corresponds to the direction of turn of the vehicle. The indicator lights are in orange color and have slightly lesser wavelength compared to red color and stand before red color in VIBGYOR pattern. The study is particular about the four-wheeler especially a car[3]. Drivers are required to use the turn signals to indicate their intention to take a turn, lane changing, or overtake a vehicle.

Almost 50% of the drivers either fail to indicate while changing lanes or do not turn the indicator off[4]. While failing to indicate a turn might seem like a small violation, several car accidents are caused while turning without indication or during lane changing.

An object of the invention is to provide for the giving of an indication by the operator of a moving vehicle and subsequent withdrawal of the indication after the vehicle has traveled a predetermined distance without further attention on the part of the operator[5]. A corollary object is to provide for the cancellation of the indication by the operator at any time before the expiration of the predetermined time.

The vehicular movement indicator safety system generates instantaneous signals alerting drivers to a change, eliminates the uncertainty, ambiguity, and confusion prevalent with existing turn signal and brake indicator systems, and significantly enhances the ability of drivers to quickly perceive and react to changes in the movement of other vehicles in substantially all traffic situations and under adverse as well as normal visibility and weather conditions[6].

Today there is global positioning system (GPS) devices available to display the position of the vehicle (longitude and latitude). Using the GPS, the vehicle indicator systems are to be functioned autonomously in near future.

2.1. Historical background of Vehicle directional indicator system

Directional indicators play an important role in driving. They provide knowledge to other road vehicles about the turn or movement of our vehicle. But in most of the time, drivers fail to use the directional indicators. In the early 20'th century the hand signals were used to indicate the turn. The early drivers used to read these signals to avoid accidents on the road.

Even today hand signals are still used. The idea of hand signaling led to the invention of the device called the mechanical signaling arm by Douglas-Hamilton in 1907[7]. This device was shaped like human hands so that it would be easy to understand. This device was attached to the car's rear side bumper and it was operated using a push button. As in the period of automobile evolution, the first modern indicator lights were designed by A.

Walz in 1925 and it was evolved along with the period. In the 1950s the manufacturing of automobiles with indicator lights became mandatory. Rules and regulations were made in different countries. In 1973 the indicator lamps are introduced to motorcycles also. In 1980 a new type of indicator light was introduced and it is called LED technology. It is used widely by all manufacturers because of its energy efficiency and durability[8]. Later many innovations were made in indicator systems. The three-blink function system was developed by Ford in 2011. Nowadays some cars have indicator lights placed in the side mirrors. Directional indicators would serve as lifesavers if we use them correctly.

2.2. Review of Components of Autonomous vehicle indicator system

The list of the parts of the autonomous vehicle directional indicator is as follows:

Global Positioning System- It is a device used to identify the position or movement of the vehicle.
Control unit- It is a component that controls the functioning of the entire circuit. The micro-controllers are used for this purpose.
Battery- The vehicle's battery is used as the power source for the other components in the circuit.
LED bulbs –LED bulbs of yellow color are used as indicator lights.

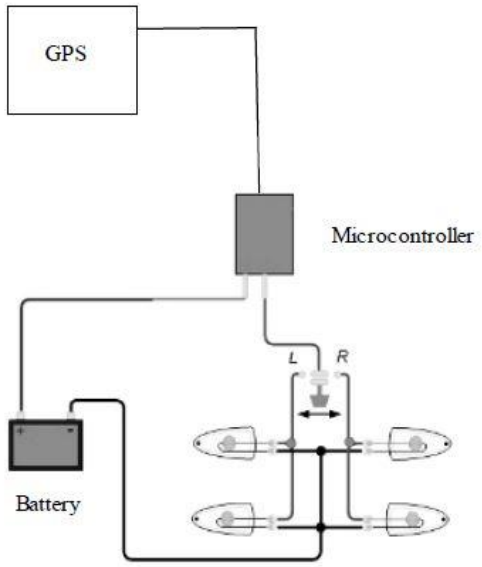

Fig 2.1. Block diagram of the directional indicator system

2.3. Review on parameters affecting the performance

The process parameters affecting the performance are listed below**.**

2.3.1 Power source
2.3.2 Signal Obstruction
2.3.3 Weather conditions
2.3.4 Micro-controllers

2.3.1. Power source

The power source is very much important for the functioning of the vehicle indicator circuit. Usually, the batteries mounted in the vehicles are used as the power source for the entire lighting system in the vehicles. Likewise, the vehicle battery serves as the power source for our autonomous vehicle indicator system. The battery

should be in proper working condition and the acid levels in the battery must be monitored periodically.

2.3.2. Signal Obstruction

GPS, whether it is a mobile phone or a standalone GPS device, requires a variety of factors to determine and display accurate location. Buildings, trees, tunnels, mountains can prevent GPS signals from the satellites from reaching the receiver. It is always better to mount the GPS device facing the clear and unobstructed view of a large portion of the sky.

2.3.3. Weather conditions

The weather conditions stand as an important parameter in the directional indicator system. For the proper working of the GPS and electrical circuits, the weather condition should be quite good. When the weather conditions are clear the GPS will get a good amount of signal from the satellite and the working of the directional indicator will be precise. But in case of bad weather conditions, the GPS could not get adequate signal from the satellite so the working of the autonomous directional indicator will be in vain.

2.3.4. Micro-controller

The micro-controller is the most important component of the autonomous vehicle indicator system as it is used to get the directional information of the vehicle from the GPS and process the information and convert it to electrical signals. A microcontroller contains one or more CPUs along with memory storage. Micro-controllers are widely used in automatically controlled products. The interrupts in the micro-controller may happen due to internal device problems. A low power supply can also cause an interrupt in micro-controller functioning[10]. Typically, the micro-controllers must be programmed correctly such that they fit the specific type of work. A microcontroller is a computer on a chip. Micro suggests that the device is small, and the controller tells you that the device' might be used to control objects, processes, or events. Another term to describe a microcontroller is embedded controller, because the microcontroller and its support circuits are often built into, or embedded in, the devices they control. It is a temporary storage unit. A microcontroller is a complete microprocessor system built on a single IC[11]. Microcontrollers were developed to meet a need for microprocessors to be put into low-cost products. Building a complete microprocessor system on a single chip substantially reduces the cost of building simple products, which use the microprocessor's power to implement their function because the microprocessor is a natural way to implement many products.

2.3.5. Indicator lamps

The Light Emitting Diode is mostly used in the automotive indicator lighting system. In modern vehicles, the lighting system is entirely made using LED lamps. The life cycle of the LED lamps is quite large and they can withstand high vibrations too. But the LED lighting system is highly sensitive to heat. The continuous usage of LED lights for more hours can produce an excessive amount of heat which may cause the failure of LED bulbs. But in recent days UV-resistance LED bulbs are produced which can withstand excessive heat without failure.

2.5 Review conclusion

The above-mentioned contents give a brief idea on the introduction of autonomous vehicle directional indicator system to the market, the components involved in the system, and the parameters involved in designing a system. Though the contents were contrary among various authors, the core design remains to be the same. The contents from the above-mentioned reviews are taken into consideration for the design and development of the system

3. METHODOLOGY AND DEVELOPMENT OF CIRCUIT

The design generation is completely based on designing the circuit and methods to develop it. First, we analyse the need for an autonomous vehicle directional indicator system, and then we identified various ideas to solve this problem. Those concepts were got researched and rated utilizing the scoring matrix concept and finally, the best concept is selected by the result of that scoring matrix table. Then the circuit design is reanalyzed for appropriate components. Then the circuit is simulated to ensure workability of the circuit. The steps involved in designing the autonomous vehicle indicator circuit are given as a flowchart below.

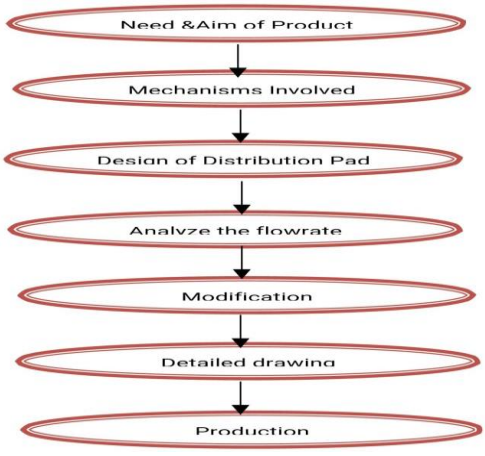

Fig 3.1 steps involved in Autonomous vehicle indicator system design and development

3.1.1. Mechanisms involved in circuit design

It is completely based on the GPS. When the driver sets a destination (i.e. The location to be reached) using google maps, with the help of micro-controllers we convert the information gathered from GPS into electronic signals and the power is given to the respective indicator lamp depending upon the direction of movement of the vehicle.

3.1.2 Method of design and simulation

The Autonomous Vehicle Indicator System is modeled using PROTEUS version software and simulated in it by programming it so that the working conditions of the system can be analyzed.

3.2 Design development of Autonomous Vehicle Directional Indicator System

3.2.1 Concept generation

The Autonomous Vehicle Directional Indicator System is designed and developed using the "Concept Development process" method as shown in Fig 3.2. Concept generation is the process of introducing new ideas based on the inputs and complaints provided by the customers. They should be more synthetic than analytical. The idea is not to check or judge the concept with its feasibility, instead to come up with various concepts regardless of their practicality. The four steps involved in concept generation are listed below.

- Preparation – a collection of information about the problem
- Incubation – continuously thinking about the problem
- Illumination – a moment of inspiration for attaining the solution
- Verification – testing and analysis of the ideas generated

Concept generation for an Autonomous vehicle directional indicator system is done as follows.

- Preparation – problems such as people expect more safety features in vehicles.
- Incubation – thinking about that problem over a course of time.
- Illumination – idea to generate the vehicle indicator system to provide safety.
- Verification – design, drawing, and analysis of Autonomous vehicle indicator system using the idea generated.

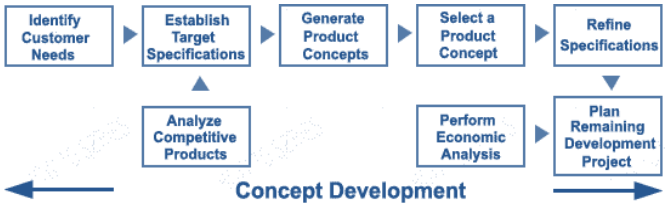

Fig 3.2 Steps involved in the Concept development process

3.2.2 Establishing target specifications

After identifying the needs of the customers, target specifications are fixed. They are simply the goals of a designing team that would satisfy the needs of the customers and could succeed in the market. Later these specifications would be refined based on the product proposal selected for production. The steps involved in establishing the target specifications are listed below.

- Preparing the list of metrics
- Collecting competitive benchmarking information
- Set ideal and marginally acceptable target values
- Reflect on the results and the process

The need table is first drawn listing the demands of the customers for enhancing the Autonomous vehicle indicator System and the importance rating is provided on a scale of 1 to 5.

3.2.3 Generation of different proposal concepts

Concept 1:

This idea was first proposed. We decided to place a sensor below the steering column so that it could sense the rotational movement of the steering. After a certain angle of rotation, the sensors will be actuated and it will make the indicator lights glow. But due to the complications in a real-time application, we made some other ideas.

Concept 2:

The idea was slightly get modified when compared to the previous one. We decided to use a mobile GPS. With the help of voice controls from google Maps services, we decided to make the directional indicator system work autonomously. For this, we decided to use some voice recognition sensors.

Concept 3:

This idea was made after collecting data about GPS and Google Maps services. We planned to get information from google maps through the mobile GPS which was connected to our autonomous vehicle indicator circuit and process that information through the microcontrollers and make the

specific indicator light glow before the turn is to be negotiated.

4. CONCLUSIONS

This study shows the role of the autonomous vehicle indicator system which improves safety and reduces driver error. It is found that the use of autonomous vehicle indicators contributes a lot in minimizing driver errors. Though the autonomous vehicle indicator system reduces the driver error effectively, they couldn't help much in terms of improving the ride comfort, keeping both the passenger safety until the driver adopts this system. Hence it is concluded from the above study that the use of autonomous indicator systemin the vehicles minimizes the driver's error to a great extent which when compared to the vehicle without autonomous directional indicator system. The paper was mainly focused on the design calculations and fabrication techniques of Autonomous vehicle directional indicator systems. As much as the population increases, vehicular usage also gets increased. This leads to increased use of vehicles and an increase in the number of accidents. The main focus of the project is to reduce accidents. This can be achieved by installing an autonomous vehicle directional indicator system in all automobiles.

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