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Smart Car Parking System

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***Abstract*:- This project deals with an effective way of finding empty spaces and managing the number of vehicles moving in and out in complex multi storeyed parking structures by detecting a vehicle using IR sensors and thus providing a feedback. The fully automated smart car parking system is rudimental and does not require heavy lines of code nor expensive equipment. It is a simple circuit built for the exact need of purpose. This automated system is used to find the vacancy in parking spaces available and navigate the driver to reach the desired space using visuals and in an effective manner, thus reducing search time. This system is required for malls, multistorey parking structures, IT hubs and parking facilities. This makes sure the requirement of labour is insubstantial.**

Keywords: Automated, smart car parking system, IR sensor

I. INTRODUCTION

In the present scenario around us we see excess vehicles and the ineffectiveness to manage them in the correct order. As the population increases day by day the rate of utilization also increases and coping up with the numbers becomes a task.
An omnipresent problem around the world is finding a parking space to park your vehicle. This task looks simple on side roads and interior lanes but the actual problem arises when parking in malls, multistorey parking structures, IT hubs and parking facilities where several hundred cars are parked and it becomes arduous to find a spot. The general approach to finding a parking space is to go around and drive aimlessly until a free space is found. Finding a parking space could be the easiest task or could be the most tedious one when it involves wide acres of distributed space across one level or multiple levels. The time and fuel are consumed unnecessarily because the destination is unknown. The easiest way of approach is to provide a destination specific driving within the parking structure.
A smart car parking system gives a visual output indicating an available parking space rather than driving aimlessly. The driver looks up to the row of LED lights and their colour to deduct a result of determining the parking space availability. The two main colours used are red and yellow stating occupied and free respectively. These lights are placed at the ceiling of each parking space and the driver looks up and follows the set of LEDs and searches for a Yellow one. These lights are controlled automatically with sensors and the feedback is provided through the colour of the LED when a vehicle is detected. This system not only makes the accessibility easy but also manages the congestion of vehicles avoiding long search and wait times.

Fig 1.1 Multi-storeyed parking structure

Fig 1.2 Underground parking structure

II. METHODS AND MATERIAL

A. Methodology

The parts which are going to be used in these projects are 3D modelled and drafted in Solid works software according to the dimensions. This gives us the overview of how the model will look after assembling all the components by using selected dimensions.

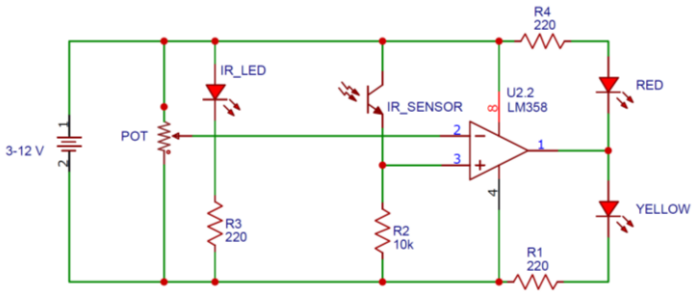

Fig 2.1: Schematic of Smart Car Parking system

The schematic is designed using Eagle software and it gives us an overview of the position of components in the circuit.
The Infra-Red rays are inconsistent and are present everywhere. To stabilize this inconsistency, an IR Emitter is used to project the radiation light. The light waves which are emitted cannot be seen in the visible spectrum. Once the emission becomes consistent the IR receiver receives these radiations and converts them into an electrical signal thus creating a potential difference. As the radiations increase, the voltage increases causing more current to flow. To obtain this the distance of reflection of waves must decrease.
To summarize this the voltage of the circuit increases when any object comes closer.
The prototype will be run in the required conditions and will be tested accordingly.

B. Components Used

- Infra-Red emitter
- Infra-Red receiver
- LED
- Infra-Red Sensor

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- Breadboard
- Potentiometer
- IC LM 358

1. *Proximity sensor*

Proximity sensors include all sensors that perform non-contact detection using infra-red waves. Proximity sensors detect movement or presence of an object and convert them into an electrical signal. There are 2 LEDs, one being the infra-red emitter emits rays and the other infra-red receiver receives these rays and convert them into an electrical signal which creates a potential difference.

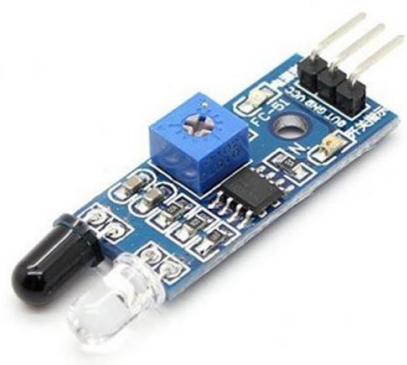

Fig 2.2 Proximity Sensor

2. *Potentiometer*

A potentiometer is defined as a 3-terminal variable resistor in which the resistance is manually varied to control the flow of electric current. A potentiometer being an electrical component can mimic an adjustable voltage divider.

It is a passive electronic component which works by varying the position of rotation contact across a uniform resistance. The entire input voltage is applied across the whole length of the resistor, and the output voltage is the voltage drop between fixed and sliding contact.

The rotary type potentiometer is used mainly for obtaining adjustable supply voltage to a part of electronic circuits. This type of potentiometer has two terminal contacts between uniform resistance is placed in a semicircular pattern. The device also has a middle terminal which is connected to the resistance through a sliding contact attached with the rotary knob. By rotating the knob, the voltage is taken between the resistance end of the contact and the sliding contact.

Fig 2.3 Potentiometer

3. *Infra-Red Sensor*

An infrared sensor is an electronic device, that emits infrared rays so as to detect a few parts of the environment. An IR sensor can gauge the warmth of an object as well as detects the motion. These sorts of sensors measure just the infrared light that falls on them, as opposed to transmitting it that is called as a passive IR sensor. Most of the objects radiate some type of warm radiations. These sorts of radiations are imperceptible to our eyes. It can only be identified by an infrared sensor. The emitter is just an IR LED (Light Emitting Diode) and the detector is basically an IR photodiode which is delicate to the IR light of a similar wavelength as that discharged by an IR LED. When the imperceptible light falls on the photodiode, the resistance and the output voltages change in relation to the size and intensity of the IR light. They require very low power and do not require any kind of contact for detection, they are not affected by oxidation or corrosion. IR sensor is used in this project by considering all these advantages.

Fig 2.4 IR sensor

4. *Infra-red Receiver*

Infrared receiver is used in an IR system to control and operate devices by sending signals. The main component of the IR receiver is a photodiode. A photodiode is a semiconductor which converts light into electrical energy. The current is produced when photons are absorbed in the photo diode.

In compendium, these devices pick up infrared signals from your remote control just like a television or cable box. After receiving the infrared rays, the signals are amplified and encoded suitable for transmission. Receivers must be located in the vicinity you wish to use as it requires line-of-sight transmission.

In order to extend the range of an infrared remote control, it is possible to combine an IR transmitter and receiver with another component. A hardwired extender unit uses a transmitter and receiver are connected by a physical wire. This wire can be routed through a wall, with the transmitter located in one room and the receiver in another. When a signal is sent to the receiver, it travels across the wire and is then turned back into infrared light by the transmitter at the other end.

The LM 358P is an example of a receiver which provides outstanding value for cost sensitive applications.

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Fig 2.5 IR sensor

5. LED

A light emitting diode (LED) is a semiconductor which has a light source that projects light when current is permitted to move through it. The electrons in the semiconductor join with the electron gaps, combine and discharge vitality as photons. The shade of the light (comparing to the vitality obtained by the photons) is found by the requirement for electrons to cross the vitality hole or threshold of the semiconductor. White light is emitted by utilizing a few different semiconductors. LEDs are considered over other radiant light sources due to the following reasons.

- Lower vitality utilization
- Longer lifetime
- Improved strength
- Small in size
- Faster rate of exchanging

In any light discharging diode, the recombination of electrons and electron openings in a semiconductor creates light (or infrared radiation). This procedure is designated "electroluminescence". The wavelength of the light is relied upon the hole of the vitality band in the kind of semiconductors utilized. Since these materials have a high list of refraction, plan highlights of the gadgets, for example, extraordinary optical coatings are important to emanate light effectively with low wastage.

C. Working

The smart car parking system works on the simple principle of detecting obstacle and sending a visual feedback. The proximity sensor is mounted on the ceiling of the parking lot which consists of an Infra-Red emitter and a receiver. The IR emitter emits infra-red rays and these rays generally bounce off objects. The IR receiver receives these rays and converts them into an electrical signal creating a potential difference. The resulting potential difference helps complete the circuit. The LEDs are placed along the driveway and switch on based on the input received by the sensor. A threshold distance is calibrated using the potentiometer to fix a particular distance based on the average height of vehicles for sending and receiving the radiations. Resistors are provided to ensure the safe working of LEDs and IR sensors. For this project based on size a 12V battery is used to power all the components.

Case 1: When the parking space is empty, the IR emitter emitting the rays will not bounce back an object (vehicle) is not detected. The rays will not strike the IR receiver and hence there will be no rise in potential difference. The feedback of this result makes the Yellow LED switch on indicating the availability of a parking space.

Case 2: When the parking space is occupied, the IR rays emitted by the emitter is bounced back as the vehicle height is within the threshold distance and the rays strike the receiver and these waves are converted into an electrical signal creating a potential difference. The feedback of this result is indicated by the Red LED turning on and thus specifying the driver that the particular parking space is filled.

There is continuous emission of IR waves so the feedback is instantaneous. As soon as the vehicle exits the parking space, the rays don't return back and the Yellow LED switches back on.

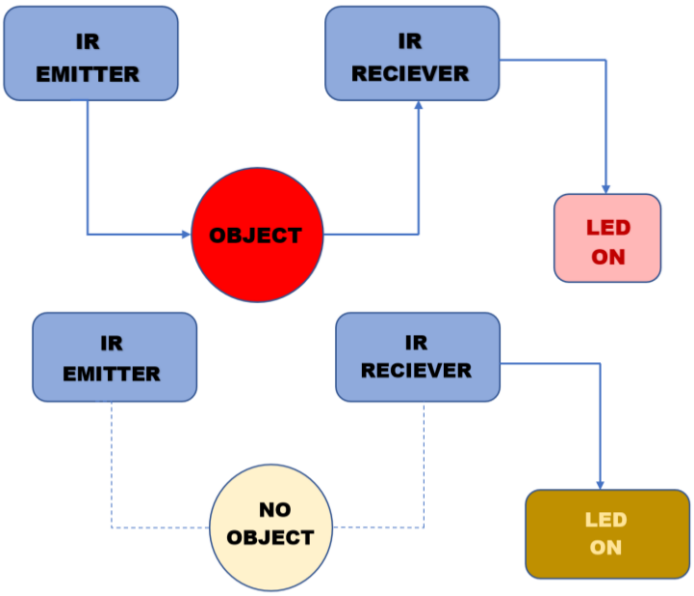

Fig 2.5 Working Block Diagram

III. GEOMETRIC MODELLING

Using the Solid works modelling software, we 3D modelled the parts and assembled it to generate a 3D prototype of the required model.

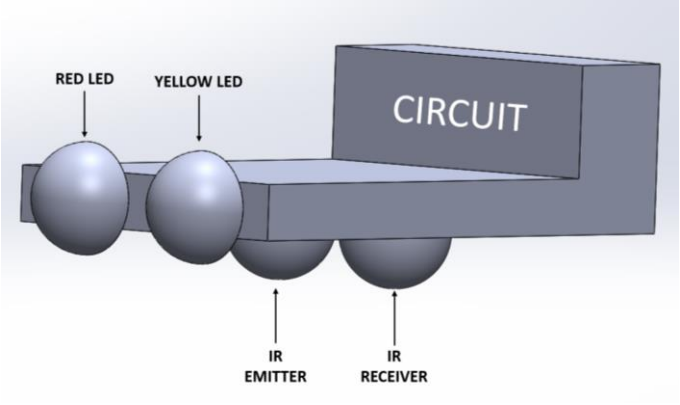

Fig 3.1 3D Prototype Assembly

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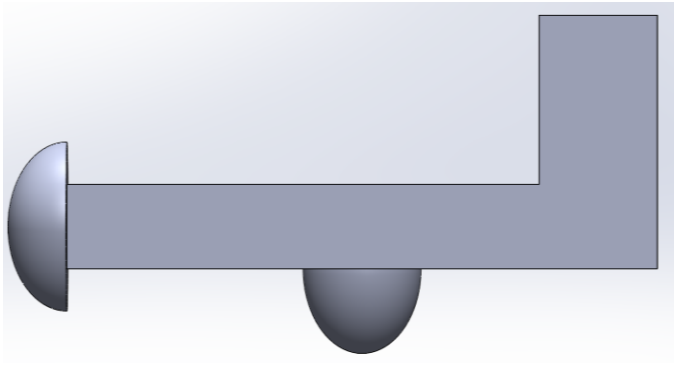

Fig 3.2 Side View

IV. CONCLUSION

Automation is a step in the right direction for a future fulfilled in the world of transportation. This design provides an effective solution to the common problem discussed. The smart car parking system was designed, fabricated and tested which provided accurate results when the threshold distance was calibrated and the obstruction was detected. The switching of LEDs based on the vehicle in the parking space was instantaneous based on no vehicle and vehicle detected.

The design is flexible and can be altered based on the space available and can be installed even in tight and constrained space. Based on the number of Yellow LEDs detected a common information board is displayed indicating the count of parking spaces available.

It can be concluded that with correct connection of some simple electrical components, it is possible to create an automatic smart car parking system, thus decreasing aimless driving, fuel and time, as well as making the process of parking considerably simpler.

V. REFERENCES

We would like to thank these authors for their help in making this project come to life. Without their papers and insight into this field, it would've been difficult to progress through this project. The only way I can thank these authors is by adding them as my reference.

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