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Automatic Car Parking Indicator System Using Arduino

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Abstract: *The aim of this paper is to provide a simple automatic car parking allocation system with basic components like microcontroller that provides solution to the problems in car parking allocation. Parking allocations provided in shopping complexes, malls, multi-store buildings etc usually have persons allocated to supervise manually the traffic and to allocate spaces available for parking, directing vehicles to be parked without any disturbances making the process more complex. A simple parking automation system with IR sensors provided at the parking space to detect the presence of vehicle parked, LED notification board to show specific empty parking slots and a display to direct individuals can avoid trafficking at the gateways of parking slots and helps them to park their vehicles easily. Therefore, the proposed research work designs and implements a prototype system model, which will regulate trafficking in parking garages along with providing information to the drivers about the availability of spaces. Also, a gate has been provided with servomotor whose main function is to allow and restrict vehicles inside and outside the parking garages by opening and closing the gate with respect to the information obtained from the IR sensors in the entrance and based on the information from the IR sensors in the parking slots.*

Keywords: (Infrared) IR Sensor, Microcontroller, LED's, Servo motor

I. INTRODUCTION

Parking allocation system in shopping complexes, multistore buildings, apartments usually have parking slots, garages regulated by human interferences. This is a timeconsuming process to find a perfect place to park the car of any individual. There are no proper indications given in the gateway about the availability of spaces inside the garage. The driver has to go all the way inside with his/her vehicle to find a proper empty space to park their vehicle and incase of not availability of spaces the driver has to come out to through the entrance and search for space in another floor. Hence high traffic congestion exists in the gateway of the parking slots especially during peak hours and the time loss in that process could be avoided by reducing human interference in allocating parking slots along with providing information about the empty parking slots available.

II. REVIEW OF LITERATURE

2.1 Study of Existing System

Currently, car parking systems range from simple manual parking to advanced automated systems. Some common existing systems include:

- Manual Parking: Requires human intervention to find an available spot.
- Sensor-Based Parking Assist: Uses ultrasonic or infrared sensors to help drivers park by detecting obstacles.
- Automated Multi-Level Parking Systems: Utilize conveyor belts, lifts, and robotic arms to optimize space usage.
- Smart Parking Solutions: Integrate IoT and mobile apps to show available parking spaces in real-time.

While these systems improve efficiency, they often lack cost-effectiveness, easy implementation, or real-time indicators for individual parking spots.

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Problem Statement

Parking in crowded areas is a major challenge, leading to:

- Difficulty in finding vacant spots.
- Wasted fuel and time due to unnecessary searching. Risk of minor accidents due to improper parking.
- Lack of an affordable, easy-to-implement parking guide system.
- A low-cost, Arduino-based automatic car parking indicator can address these issues by efficiently guiding drivers to available spaces.

2.2 Project Scope

The proposed system will:

- Utilize ultrasonic sensors to detect empty parking spaces.
- Use an Arduino microcontroller to process data from sensors.
- Display available parking spots using LED indicators or an LCD screen.
- Potentially integrate with a mobile app for real-time updates.
- Be cost-effective and suitable for small to medium- sized parking lots.
- The system will be designed for indoor parking areas (e.g., malls, offices) and can be expanded to outdoor environments with additional modifications.

2.3 Objective of Proposed System

The main objectives are:

- Automate parking space detection using sensors.
- Provide clear indicators (LEDs or a display) for vacant and occupied spots.
- Reduce search time and fuel consumption by guiding drivers efficiently.
- Improve safety by minimizing parking-related accidents.
- Develop a scalable and cost-effective solution for various parking lot sizes.

III. METHODOLOGY

3.1 Proposed Methodology

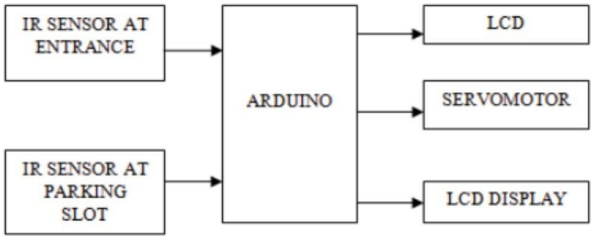

Fig 1. Block Diagram Automatic Car Parking Indicator System Using Arduino

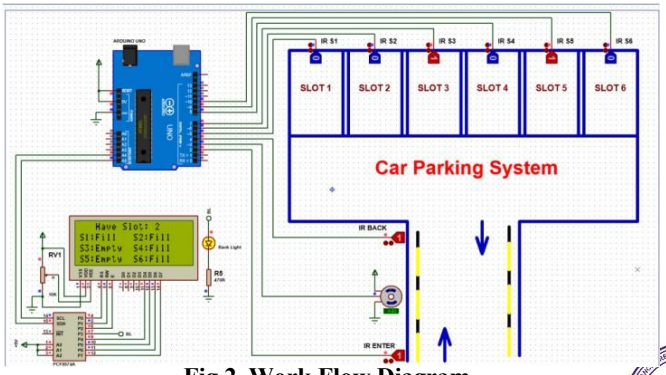

Fig 2. Work Flow Diagram

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3.2 System design and components

Hardware Components

- Arduino Uno ((1 unit) – Acts as the brain of the system, processing sensor data and controlling outputs like LEDs, buzzer, LCD, and servo motor.
- LCD display (1 unit) – Displays real-time distance readings, parking status, and alerts to assist the driver.
- Servomoter (1 unit) – Controls an entry/exit barrier (if included in the system) to allow or block vehicle movement based on parking availability.
- IR Sensors (4–6 units) – Detects whether a car is present in a parking slot and sends data to Arduino. Can be used to track available parking spots.

Software Tools

- Arduino IDE – For writing , compiling and uploading code to the Arduino board.

IV. CONSUMABLES

Microcontroller

Arduino Uno/Nano – The brain of the system that processes sensor data and controls indicators.

Sensors

Ultrasonic Sensor (HC-SR04) – Measures distance to detect obstacles (e.g., walls or other vehicles).

Indicators

- **LEDs (Red, Yellow, Green) –** Show parking status (e.g., safe, caution, stop).
- **Buzzer** – Provides audio alerts for close proximity.
- **LCD Display (16x2 or OLED – Optional) –** Shows distance readings or parking availability.

V. ADVANTAGES AND DISADVANTAGES

Advantages

- It helps in finding empty parking slots before entering inside the parking area.
- It regulates the entry of excess vehicles when all the slots were occupied.
- IR Sensors are placed in such a way that all types of cars ranging from hatchbacks to MUVs.
- It is suitable for all kinds of buildings.
- Requires low maintenance.
- Sensors used are very simple and optimized based on our needs.
- Simple system and cost of construction is low.
- Regulates traffic in front of the parking slots.
- Gives proper instructions through LCD displays.
- User friendly

Disadvantages

- **Limited Accuracy –** Ultrasonic sensors can be affected by environmental factors like temperature, surface angles, or nearby objects, leading to inaccurate readings.
- **Short Detection Range –** Most HC-SR04 sensors have a limited range (2cm to 400cm), making them unsuitable for large parking areas.
- **Not Suitable for All Vehicles –** The sensor placement might need adjustments depending on the vehicle's height and size.
- **No Object Differentiation –** The system cannot distinguish between walls, people, or other cars, which may cause false alerts.

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- **Power Dependency** – Requires a continuous power supply, making it unsuitable for extended use without a stable source.
- **Wiring Complexity –** Multiple sensors and components require careful wiring, which may be challenging for beginners.

VI. APPLICATIONS

- **Smart Parking Lots** – Used in commercial and residential parking areas to guide vehicles into available spaces efficiently.
- **Home Garages –** Helps drivers park safely in confined spaces by indicating proximity to walls or obstacles.
- **Shopping Malls & Airports –** Enhances the parking experience by showing available spots and preventing congestion.
- **Automated Parking Systems –** Used in fully automated parking facilities where vehicles are parked with minimal human intervention.
- **Underground & Multi-Level Parking** – Assists drivers in navigating tight spaces and avoiding collisions in dimly lit areas.
- **Traffic Management** – Can be integrated with smart city solutions to improve vehicle movement in crowded areas.
- **Special Assistance for New Drivers** – Helps inexperienced drivers park safely with guided indicators

VII. CONCLUSIONS AND FUTURE WORK

This system gives solution to the problem of traffic congestion in front of the parking garage. Conventionally there is no such automated system for allocating spaces for parking vehicles. So, this will make parking allocation simple and well organized with systematic first come first serve basis. Directing people to empty parking slots and indicating exact locations adds more credibility to this system. In case of no space in that specific floor's parking garage, it will direct the driver to go to next floor for parking. These were some of the merits of the system. Though this will be useful, there is no assurance of its speed of regulation when more vehicles accumulate. It may regulate the traffic, but this system will not be very useful during leisure hours and this system cannot work ideally. The concept of pre-booking of parking slots will be new but it will create some confusions. If the person who booked a parking slot arrived lately, the place should be spared to another individual.

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