

Vehicle Parking Management System using Load Cell Sensor

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Abstract - In big urban cities traffic and parking are biggest problems for commuters. This system is designed to provide dual services of checking unauthorized parking and parking navigation to big commercial campuses such as educational institutions, shopping malls, offices etc. this system is specially designed for parking lot of crescent university, Chennai. The system counts the number of vehicle entering and leaving a campus. The system also senses the type (2-wheeler, 4-wheeler, load carrier) of vehicle and informs the driver through a LCD display the empty space and direction for parking of their vehicle. The system uses load cell sensor to identify the sort of vehicle based on its weight and the count the number of vehicles.

Key Words: Vehicle navigation, load cell sensor, Parking management, micro controller 8051, embedded program, GSM module.

1. INTRODUCTION

Parking inside every big institute's campus is difficult to manage as long as the security personnel are deployed for intended purpose. The project is mainly to provide easy and hassle free parking service to visitor of campus and also to check unauthorized parking time to time with minimal human effort. The system uses load cell sensor to check the type of vehicle and count the number of vehicles. The GSM alert system provide SMS alert every time the parking lot reaches its present threshold value so that the upcoming vehicle entering the campus can be diverted to a new location within the campus. The drivers are navigated into the parking space based totally on the car type. Installation of this gadget apart from the intended place has to go through minimal modification based at the geography of the place wherein the machine might be installed. It used to be found that all the existing structures were based on GPS satellite, excessive speed cameras which as restricted to either a single user or a small geographical area. There was no centralized gadget or technology to provide navigation and parking solution to all kinds of vehicle and to everyone.

2. OBJECTIVES

The goal of the system is to provide automated navigation system based on vehicle type and to check the parking location is full. The proposed system is far different from the existing systems. The system makes use of the load cell sensor placed beneath a speed breaker like structure over

which the vehicle passes and gives an input to the microcontroller.

3. BLOCK DIAGRAM

The operation of the system with block diagrams is discussed as below:

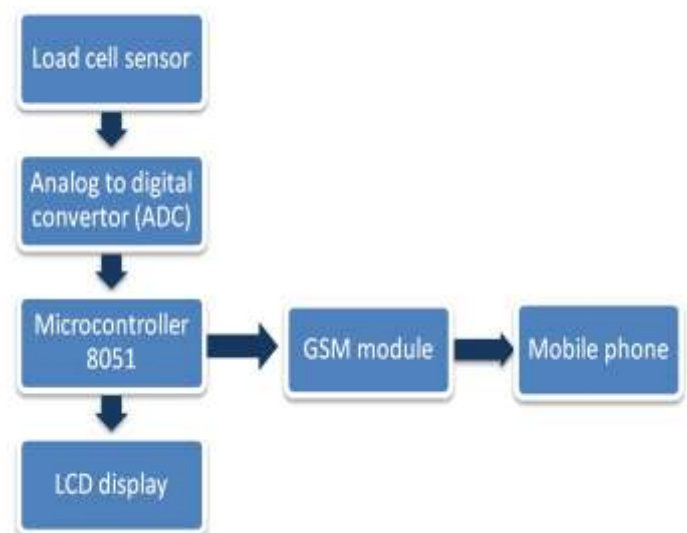


Fig -1: Block Diagram

4. METHODOLOGY

The vehicle enters the campus, and goes over a speed breaker. The load cell sensor undergoes compression which changes the resistance in one arm of the balanced bridge thus making it unbalanced and the magnitude of this imbalance is directly proportional to the weight of the vehicle. An Analog-to-digital convertor (ADC) is placed as interference between the load cell sensor and the microcontroller so as to supply a digital input to the microcontroller and also work as an amplifier. This variation are taken as the input and is given to the microcontroller, now the count goes from zero to 1, similarly the entire vehicle coming into is counted. The barrier gate is fixed in the entrance of the parking area which opens mechanically after the system senses the type of vehicle.

The system is programmed to alert the security personal through SMS in 2 situations

1. When the parking lot is almost full. (i.e.) it reaches the threshold value.
2. When there are vehicles in the parking lot post the working hours.

The program also has additional features of sensing the type of vehicle based on weight. So could intimate the driver through LCD display on where the lot is free for parking.

5. SOFTWARE AND HARDWARE REQUIREMENTS:

- Embedded C
- Microcontroller 8051
- LCD display
- Analog-to-digital convertor
- GSM module
- Load cell sensor
- DC motor

6. SYSTEM DESIGN:

The overall system comprises of many software and hardware components which is used to design a system that works in cost efficient way and prevents the count of unwanted interceptions.

6.1 Load cell sensor

A load cell sensor is a transducer that is used to create an electrical magnitude whose magnitude is directly proportional to the pressure being exerted. Various kinds of load cells are available that incorporate pneumatic load cell, hydraulic load cell and strain gauge load cell. In this system strain gauge sensor of maximum load capacity of 300kg is used. Load cell for the most part comprise of four strain checks in a whetstone bridge. any vehicle passed over the mechanical structure will experience pressure in the sensing device so there will be change or deformation in one arm of whetstone bridge this gives the changes in electrical signal. The output electrical signal from the sensing unit is then amplified, as the output sign is typically in the order of few millivolts.

Specifications:

- Capacity: 300Kg
- Dimensions: 150 mm x 40 mm x 40 mm
- Wire Length: 1.5 meter
- Type: Single Ended shear beam load cell



Fig -2: Load cell sensor

6.2 Micro controller 8051

A 8-bit micro controller with 4kb of ROM storage and 128 bytes of RAM storage, which is programmed (embedded C) to control and operate overall system. Two 16-bit timer/counter (T0-T1) is connected to the load cell sensor through which input signal is obtained. 8051 micro controller is interfaced with GSM module sim900A that send SMS alert to the respective person mobile with current vehicle count.



Fig -3: Micro controller kit

6.3 Power supply unit and voltage regulator

All electronic components generally work with a DC supply ranging from $\pm 5V$ to $\pm 12V$. We are utilizing the commonly using energy source of 230V – 50Hz AC supply by stepping down, rectifying, filtering and regulating the voltage. The voltage regulator used here in the setup will maintain steady

level of voltage flow automatically. It can be a easy feed forward or have a negative feedback loop. Voltage in transmitter and receiver are maintained constantly by voltage regulator. The controller used right here is to step down the voltage provided in the transmitter and receiver. The board (micro controller kit) is feed with 10 amps input power and is carried to load cell sensor through Analog-to-digital converter setup. GSM module requires separate 1 amps input power.

6.3 Liquid crystal display

A liquid crystal display is a device which is usually flat and makes uses of liquid crystal. It is digital visible display that makes use of the light-modulating properties of liquid crystals do not emit light directly. LCD's are available to show arbitrary images (as in computer display) or constant images with low information content, which can be displayed or hidden, such as words, digits etc.

Specifications:

Operating Voltage: 4.7V to 5.3V DC

Character allowed: 32 characters

Pixel capacity: (32×40) 1280 Pixels



Fig -4: LCD display 16*2

6.4 Liquid crystal display interfacing with 8051 microcontroller

8051 micro controller consists of 40 pins with four 8-bit ports (P0, P1, P2, and P3) which are connected to data pins of the LCD. In the command register of LCD the instructions which are to be executed is stored, character to be shown on the LCD is put away in the data register. The ideal character to be appeared in the LCD can be accomplished by sending the order or command and information to the device.

6.5 GSM module interfacing with 8051 microcontroller

GSM module sim900A works with 12V DC and the microcontroller works with 5V. So, interfacing of this modem with microcontroller directly is no longer feasible due to mismatch of voltage levels. GSM modem is interfaced with

8051 microcontroller via MAX232 with the assist of RS232 cable for serial communication. During serial communication between microcontroller and GSM sim900A the MAX232 device will convert Transistor-Transistor Logic (TTL) level to RS232 level. RS232 device acts as an interface and conducts information through serial communication. Once the GSM module sim900A is connected physically with 8051 micro controller then program is loaded to send SMS

7. RESULT AND DISCUSSION

The load cell device differentiates the kind of vehicle based on the exerted load and counts the vehicle through microcontroller. The GSM sends a SMS alert once the amount of vehicle count reaches the threshold value set based on the vehicle parking capability. The gate opens based on the type of vehicle and closes mechanically after ten seconds delay.

8. LIMITATIONS

Although the system is very cost effective and easy to adapt, still have some limitations like cannot distinguish the type of vehicle when simultaneously vehicle are passes the sensing device. Also the phone must be in turned ON condition in the receiver end every time and network signal strength must be sufficiently strong enough for the alert system to be work effectively.

9. CONCLUSION

This device is fully automated and can be adapted to any commercial, industrial location with minimal human effort and programming level. This system senses the kind of vehicle besides any high end sensors which makes it a cost efficient system. With proper mechanical aid and design this system can be implemented for real time usage in any industrial, institution parking area. This application can be broadly interfaced with parking ticket vending machines, monitoring systems, boom barriers with RFID etc.,

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