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Use of automation of machines and control systems to optimize car parking using embedded approach

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Abstract— In the paper we have shown the concept of an automatic car parking system. As in the modern world everything is going automatic we have built a system which will automatically sense the entry and exit of cars through the gate and then display the number of cars in the parking lot. Even we can set a maximum capacity of cars with the help of user interface given in the hardware in the form of switches so that there is no congestion. We have deployed a microcontroller which is used to sense the movement of cars and depending upon whether there is a capacity of cars to enter, it either opens the gate or not.

Keywords- automation,capacity,microcontroller,interface,switches.

I. INTRODUCTION

Automation is the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. The correct incentive for applying automation is to increase productivity, and/or quality beyond that possible with current human labor levels so as to realize economies of scale, and/or realize predictable quality levels. The incorrect application of automation, which occurs most often, is an effort to eliminate or replace human labor. Simply put, whereas correct application of automation can net as much as 3 to 4 times original output with no increase in current human labor costs, incorrect application of automation can only save a fraction of current labor level costs. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provides human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements while increasing load capacity, speed, and repeatability. Automation plays an increasingly important role in the world economy and in daily experience.
The following methods are often employed to improve productivity, quality, or robustness.

- Install automation in operations to reduce cycle time.
- Install automation where a high degree of accuracy is required.
- Replacing human operators in tasks that involve hard physical or monotonous work.
- Replacing humans in tasks done in dangerous environments (i.e. fire, space, volcanoes, nuclear facilities, underwater, etc.)
- Performing tasks that are beyond human capabilities of size, weight, speed, endurance, etc.
- Economy improvement: Automation may improve in economy of enterprises, society or most of humanity. For example, when an enterprise invests in automation, technology recovers its investment; or when a state or country increases its income due to automation like Germany or Japan in the 20th Century.
- Reduces operation time and work handling time significantly.
- Frees up workers to take on other roles.
- Provides higher level jobs in the development, deployment, maintenance and running of the automated processes.

The term *automation*, inspired by the earlier word *automatic* (coming from *automaton*), was not widely used before 1947, when General Motors established the automation department. At that time automation technologies were electrical, mechanical, hydraulic and pneumatic. Between 1957 and 1964 factory output nearly doubled while the number of blue collar workers started to decline.

II. CONCEPT OF EMBEDDED SYSTEMS

A. Defination of embedded systems

Computing systems are everywhere. It's probably no surprise that millions of computing systems are built every year destined for desktop computers (Personal Computers, or PC's), workstations, mainframes and servers. What may be surprising is that *billions* of computing systems are built every year for a very different purpose: they are embedded within larger electronic devices, repeatedly carrying out a particular function, often going completely unrecognized by

the device's user. Creating a precise definition of such embedded computing systems, or simply *embedded systems*, is not an easy task. We might try the following definition: An embedded system is nearly any computing system other than a desktop, laptop, or mainframe computer. That definition isn't perfect, but it may be as close as we'll get. We can better understand such systems by examining common examples and common characteristics. Such examination will reveal major challenges facing designers of such systems.

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B. Characteristics of embedded systems

Single-functioned*:* An embedded system usually executes only one program, repeatedly. For example, a pager is always a pager. In contrast, a desktop system executes a variety of programs, like spreadsheets, word processors, and video games, with new programs added frequently.

Tightly constrained*:* All computing systems have constraints on design metrics, but those on embedded systems can be especially tight. A design metric is a measure of an implementation's features, such as cost, size, performance, and power. Embedded systems often must cost just a few dollars, must be sized to fit on a single chip, must perform fast enough to process data in real-time, and must consume minimum power to extend battery life or prevent the necessity of a cooling fan.

III. METHODOLOGY

In the project "Car Parking System" we have shown the concept of an automatic car parking system. As in the modern world everything is going automatic we have built a system which will automatically sense the entry and exit of cars through the gate and then display the number of cars in the parking lot.

Even we can set a maximum capacity of cars with the help of user interface given in the hardware in the form of switches so that there is no congestion. We have deployed a microcontroller which is used to sense the movement of cars and depending upon whether there is a capacity of cars to enter, it either opens the gate or not.

It is also possible to open a gate when any car enters in the parking lot or close the door when a car exits from the parking lot.

There are two sets of sensors:

1. One on the first gate (entry gate)
2. Other on the second gate (exit gate)

When a car arrives at the door the microcontroller receives the signal from the entry sensors and then checks whether there is a capacity of cars to be accommodated. Simultaneously it will also display the number of cars present in the parking lot on a LCD screen and also opens the gate.

When a car moves out of the parking area the microcontroller reduces the count displayed accordingly and also closes the gate. The user will have an option to set the maximum count for the cars with the help of switches connected to the microcontroller.

The sensing of entry and exit of cars is done with the help of Infrared transmitters and receivers. Before the door the Infrared transmitter is mounted on one side and the receiver is placed directly in front of the transmitter across the door. When a car arrives the Infrared beam is blocked by the car and the receiver is devoid of Infrared rays and its output changes. This change in output is sensed by the microcontroller and accordingly it increments the count and opens the door if there is some capacity. The procedure for the exit of the cars is similar as the entry.

IV. OBJECTIVE OF WORK

A. Purpose

The goal of this project was to take a parking lot control system from requirement generation, through model generation and validation. This document describes the process taken to present the resulting data.

B.Roles and responsibilities

The project team is formed by the following students: Ankita Sharma, Rupali Bhardwaj and Shilpa Patial. Since all team members have the same experience and expertise designing systems, the work was divided equally and assigned arbitrarily.

C. Overview

For our project, we have decided to design a system that can be deployed in existing parking structures which would provide information about available parking spaces to drivers trying to access the facility. The system will include software, sensors and the networking components.

The installation of permanent sensors in each parking space will provide lot owners with constant and accurate information on parking lot occupancy. This allows them to keep the lot at full capacity and serve customers better. It has 4 parking spaces where, 1 is reserved and 3 are available for regular lot users.

The system will make use of electronic signs to give drivers, information regarding parking availability before they enter the facility. Once inside, color coded LED displays will lead motorists to the vacant spaces. Parking spaces can be made

unavailable by the building manager bypassing the sensors. This and other configuration options will be made available through a GUI interface.

The parking system is based around a 89C51 micro-controller and U-shaped photo sensors. It is quick and efficient in operation. The micro-controller is interfaced to the PC by serial port through ICL232 which is a dual RS-232 Transmitter/Receiver.

Photo sensors and 89C51 micro-controller control the entire operation of the car parking control system collectively. The seven segment display and serial interface is used to display the number of cars in the parking lot.

Block diagram of the system is shown in figure.

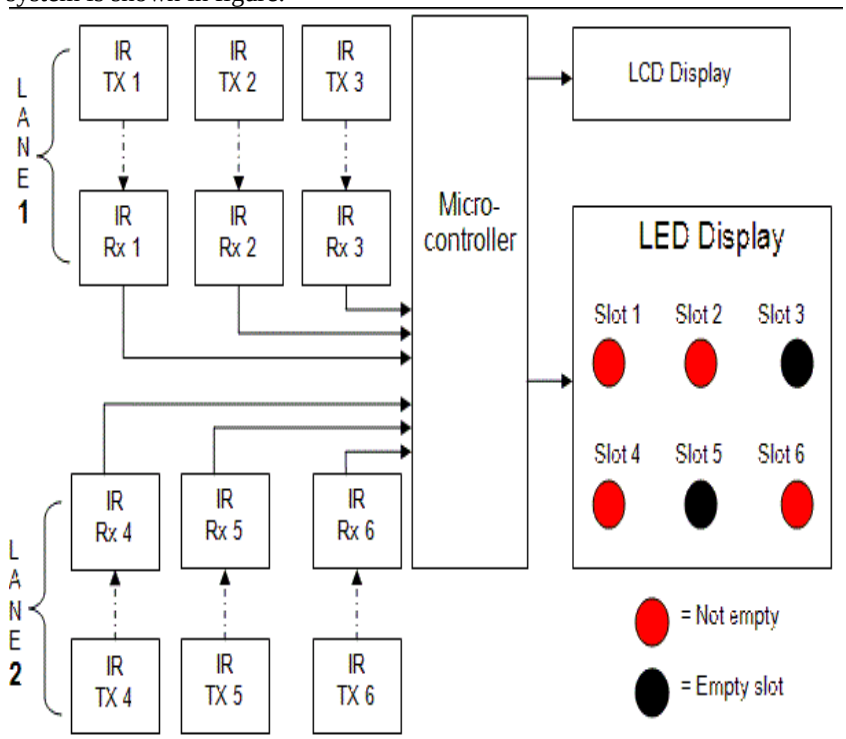


Fig 1: BLOCK DIAGRAM

D. Components of car parking systems

In the context of design and implementation of car parking control system the important components need to be taken into account are:

- **U-shaped Photo Sensors**
- **Seven segment Display**
- **Serial Interfacing**

E. Definitions

PARKING LOT

The parking lot consists of one entrance and 1 exit. There are 4 parking spaces with 1 being reserved for building staff.

ENTRANCE

The entrance consists of a gate, a display showing the precise number of available parking spaces, a tag reader. The tag reader is activated as soon as the car is within range.

EXIT

The exit consists of a gate and an induction loop that is behind the gate to detect when a car approaches the gate.

F. Working description

ENTERING

When a car arrives at the door the microcontroller receives the signal from the entry sensors and then checks whether there is a capacity of cars to be accommodated. Simultaneously it will also display the number of cars present in the parking lot on a LCD screen and also opens the gate. When a car moves out of the parking area the microcontroller reduces the count displayed accordingly and also closes the gate. The user will have an option to set the maximum count for the cars with the help of switches connected to the microcontroller.

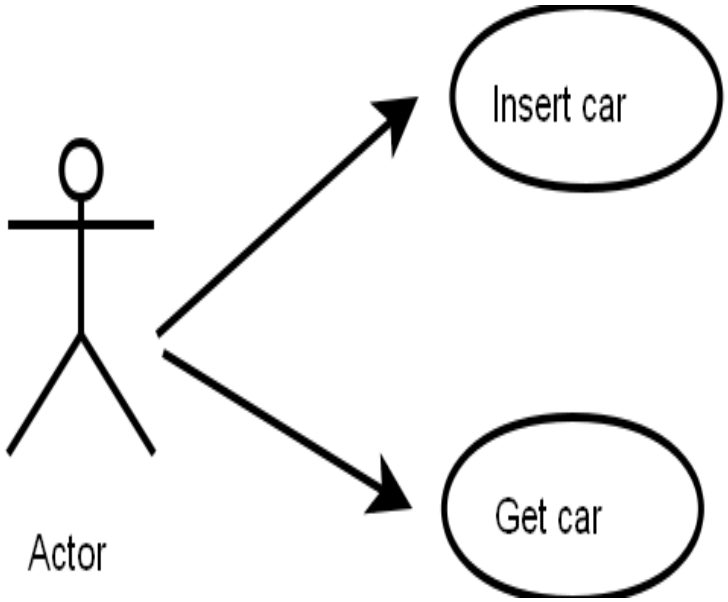
LEAVING

The sensing of entry and exit of cars is done with the help of Infrared transmitters and receivers. Before the door the Infrared transmitter is mounted on one side and the receiver is placed directly in front of the transmitter across the door. When a car arrives the Infrared beam is blocked by the car and the receiver is devoid of Infrared rays and its output changes. This change in output is sensed by the microcontroller and accordingly it increments the count and opens the door if there is some capacity. The procedure for the exit of the cars is similar as the entry.

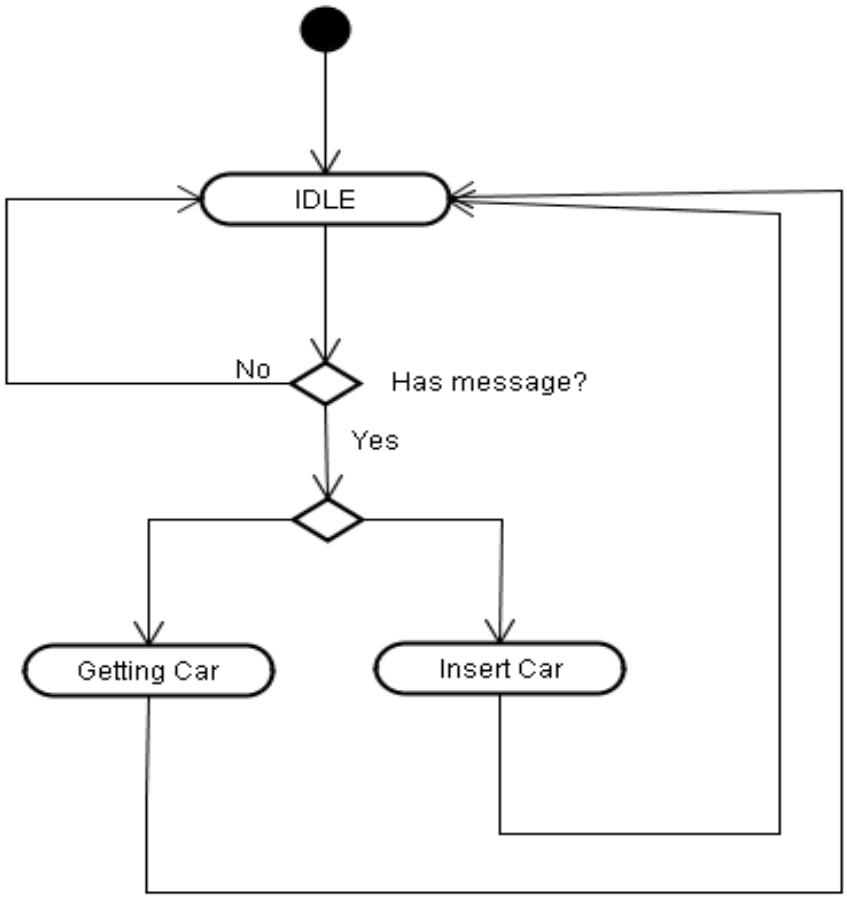
V. IMPLEMENTATION DESIGN

A.USE CASE DIAGRAM FOR THE SYSTEM

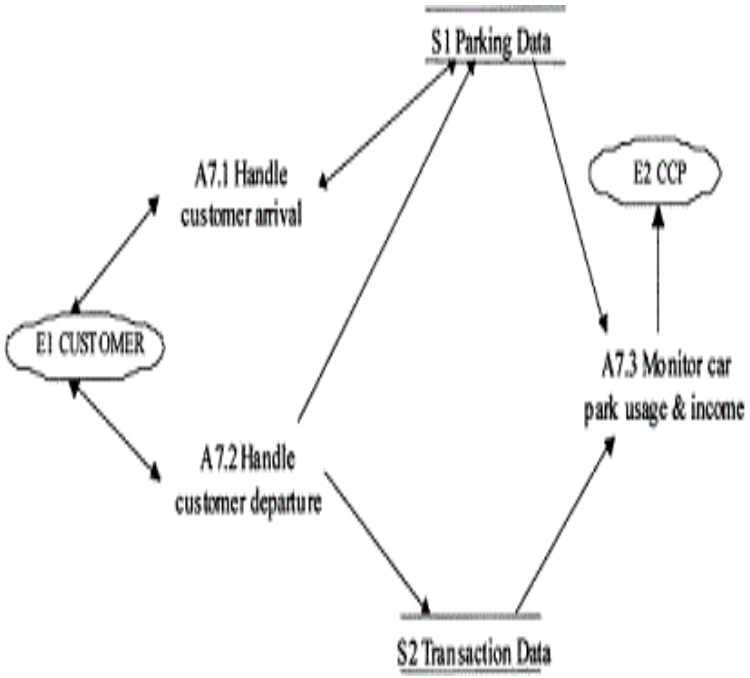
The user can only insert and get the previously deposited car:



B.ACTIVITY DIAGRAM



C.INTERACTION DIAGRAM



VI. RESULT AND RELATED WORK

A.Result

The importance of parking search is a consequence of the special characteristics of the demand for and the supply of parking opportunities in central urban areas.Some of the applications of automatic parking system are parking lots of airports, toll gates, railway crossings and other.It is a very versatile project and can be installed at various places.It modernizes the entire device control system.It is easy to install and can be made to work instantaneously.

It is reusable and can reinstall in very less time.It is environmental friendly and aims to conserve energy by switching between devices as per requirement.It is completely automated and hence it provides a great amount of comfort to its user.Expenditure on electricity consumption is highly reduced.Time and Fuel Consumption is reduced.

B.Related work

- This system will also have lots of application in industries.
- It can be used to do counting boxes, cartoons, jars during the process of packing/ manufacturing.
- It can be used to keep a track of baggage on the baggage rails used in airports.

VII. CONCLUSION

This project is basically an intelligent counter which keeps a count of the number of the things crossing by and takes appropriate actions if required to.It is a versatile project with application in almost every field, be it residential or industrial. It is a very unique system with many features and these kinds of systems are not readily available in market.I would like to conclude this project as a very great and enriching experience. During the project labs I familiarized myself with P.C.B designing, application of I.C. (its pin diagram), mounting of components using soldering process and interfacing of the hardware circuit with the computer. The circuit can be used at all places starting from domestic to the industrial sectors. The simplicity in the usage of this circuit helps it to be used by a large number of people as people with less knowledge of hardware can also use it without facing any problem. This project was not only good for personality development but also great in terms of imparting practical knowledge.Thus I conclude our project with a very nice and wonderful experience

VIII. FUTURE ASPECT AND SCOPE

A.Future aspect

This system will also have lots of application in industries. It can be used to do counting boxes, cartoons, jars during the process of packing/ manufacturing.It can be used to keep a track of baggage on the baggage rails used in airports.

B.Scope

Some of the application of automatic barriers are parking lots of airports, toll gates, railway crossings and other. We are going to use Infra Red transmitters and Receivers for each parking slot. The IR Receivers are connected to AVR microcontroller. IR rays are obstructed when a car is parked in any parking slot. Thus AVR will come to know that which slot is empty and which slot is full.We have chosen IR module instead of RF module because we want a receiver having

line of sight communication with the transmitter. But RF does not require line of sight communication. And in case of LDR, there is scope for false triggering due to sunlight or headlight of car. So considering all these points we have finalized to use IR module.For transmitter section we are going to use IR LEDs driven by a 555 timer IC. Timer IC will generate a frequency of 38 KHz, which will be given to IR LEDs.

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