AN AUTOMATED CAR PARKING SYSTEM BY USING PROGAMMABLE LOGIC CONTROLLER

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Abstract: - A primary goal of this project is to design a reliable and smart parking system for domestic as well as commercial use. This system would be helpful in saving time required for searching parking spaces for the vehicles in cities. It will consist of a screen outside the entrance of the parking area to assist the driver in finding a parking place for his car. We have designed a set up that will be equipped with sensors and programmable logic controller (PLC) module to indicate the availability of parking spaces.

Keyword:- PLC, HMI, Ardunio, Proximity Sensor, Motor, Ladder Diagram.

1. Introduction

Car parking system has become an essential component of the metro cities as the people require safe and reliable place to keep their vehicles when they are busy with their daily activities. With the increase in the availability and usage of vehicles among the people finding a space for parking the cars has become very difficult. The problems of finding parking spaces are increasing at an alarming rate in cities. The wireless and digital technologies are important tools that can be helpful in managing these parking problems [1]. Car parking is helpful to the people as it offers convenience to the people in keeping their vehicles safe. Some of the problems faced by the people in the traditional parking systems are searching for parking spaces, poor infrastructure, improper parking and rash driving skills. A lot of time and energy is wasted in searching for parking spaces using the traditional systems [2]. The problems of searching parking spaces are alleviated on public holidays and weekends. Number of people visiting shopping malls, stadiums, parks increase during these periods [3].The time required in this process can be minimized by helping the user to know the available slots when he reaches the parking areas. Utilizing this concept can be helpful for the people especially in metro cities to tackle the problems related to parking vehicles near markets, shopping malls, theatres etc.

Taking into account the problems faced by people in the existing systems, we have tried to develop an automatic car parking system that will uses PLC, proximity sensors and Human Machine Interface (HMI) to help the people in finding parking spaces. The users will come to know the availability of parking spaces in the area through this system. The problems faced by the people while parking their vehicles can be reduced and the time spent in searching for parking spaces can be minimized by using the proposed system. The paper has been arranged as follows: section 2 will contain a brief literature review of the concerned work; section 3 will briefly explain the components used in the proposed system, section 4 will explain the working and section 5 will consist of conclusion and future scope.

2. Related work

An intelligent car parking system has been described by the authors in [4] that utilize IR sensors to sense the vehicles near the gate of the parking system. The outputs of the sensors are sent to the PLC that directs the opening of the gate if any space is available in the parking area. The system uses a solar panel to reduce the power consumption of the system. There are a series of batteries that are charged using the solar panel and these batteries are utilized as power back up so that the system can work for longer periods.

The authors in [5] have discussed a concept based on industrial automation technology. This system notifies the driver regarding the available slots in the parking area. The empty slots in the parking area are displayed on the screen by which it becomes easy for the drivers to park their vehicles.

The authors in [6] have proposed a smart parking system based on PLC. It uses PLC and supervisory control and data acquisition (SCADA) based system to automate the parking process and reduce the problems related to it. It uses LEDs to

indicate the availability of the parking spaces to the users when they enter the parking zone. It uses unique passwords for the parking slots to secure the parking system and the motion sensors that turn on when the car is parked and turn off once the car is un-parked.

The car parking system proposed in [7] uses PLC and IR sensors to detect the presence of car in the slots. It helps in knowing if the parking area is empty or full. The difference in the number of cars entering and leaving the parking area is used to calculate the number of cars in the parking. In case the parking area is full the PLC sends an acknowledge signal to keep the gate closed that reflects the unavailability of parking spaces.

3. Basic Components Used in the Proposed work

i.   HMI(Human Machine Interface)

In our project, we have used OMRON HMI. Ultimately it is a very nice display that communicates with plc and system and we used NB7W-TW00B and display of HMI is 5' and it can show different reading etc. Figure1. on display on the screen there is a lot of button-like P1 to P10, IN and OUT button and we gave one representation that button from P1 to P10 is green so a car is absent and a button will show red color and if a car is present then button will show green color. The work of the home button is to return the INPUT display screen to the homepage and the work of the next button is that to switch to the next screen manual. [7]
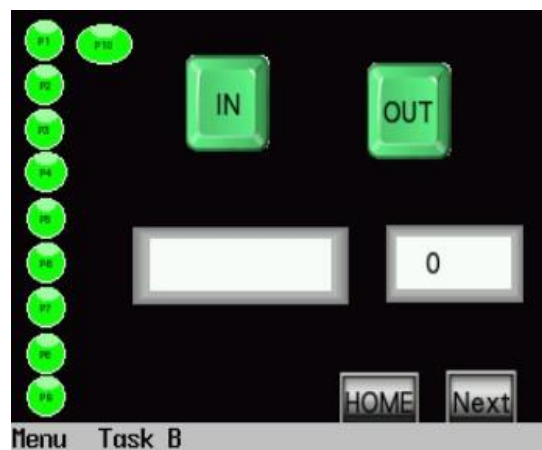

Figure 1.I/O Display Screen

ii.   Progrmmable logical control(PLC):

In this industrial sector, users are using PLC as a small PC for a different kind of need and it gives flexibility, easily programmable controller to replace hard-wired. It has been widely adopted as a high-reliability automation controller suitable for harsh environments. In this case, we used MITSUBISHI first of all PLC will get a signal through the sensor to verify slot is available or not after that PLC will give O/P signal to HMI for showing the inside condition of paring at the entrance gate for driver satisfaction.

Figure 2. MITSUBISHI FX3ge-24M PLC.

iii.   Proximity sensor:-

This sensor commonly is used on a mobile device and where we need to detect the presence of nearby objects without any physical contact. What rays come out from the proximity sensor of that rays we called the electromagnetic field.   In our system the ain use we did that user will come at the entrance gate that time sensor will send signal PLC after that PLC will perform itself task after that if slot will be available the system will allow to proximity sensor to Arduino the pen ate (rail gate) otherwise not. Ultimately like this way sensors play a big role in this project. [8]

Figure 3. Proximity sensor **iv. Working of the System**

In this parking system, first of all, users will come to the entry point. At that time first and foremost step will happen that the proximity sensor will send the signal to the control system(programmable logical control). After that system will check whether empty pallets are available or not. If any pallets are empty plc will send acknowledge signal to the gate on the human-machine interface screen for showing the inside condition of the paring entrance gate for driver satisfaction after this the Arduino board will end signal to stepper motor through proximity sensor for opening the gate (rail gate) and if space is not available then PLC will send the signal to keep the gate closed.
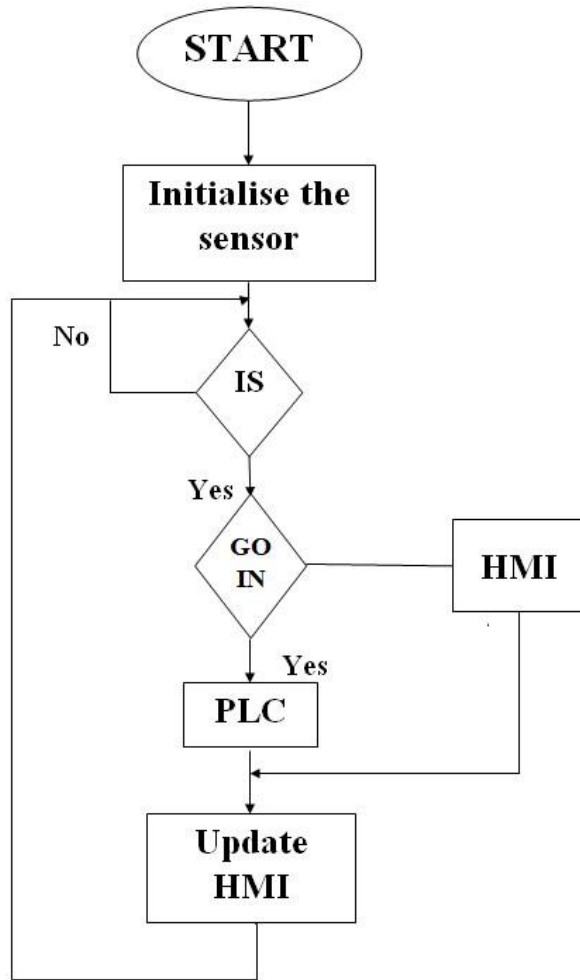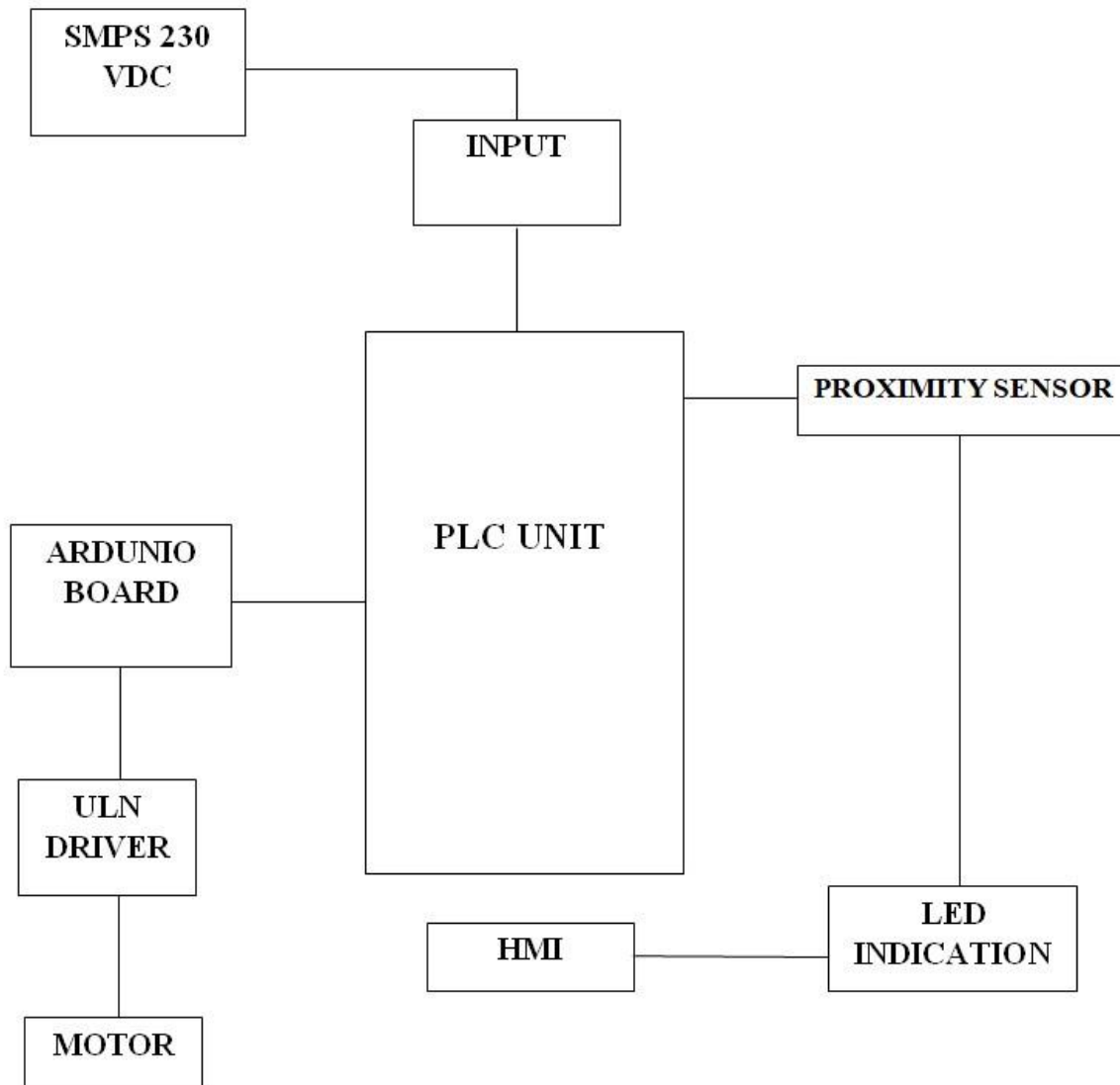
Figure 4. Flowchart

Fig 5. Block diagram

This experiment contains a simulation with ATSEL 7 of a car park with 20 car capacity. There are 20 cars space at a parking ground d 20 proximity sensors users placed on each car space to detect a presence of a car over it. We can guess that 20 cars users placed at the parking then proximity sensor sends this count to PLC for operation and give to the result on the screen which is available outside. On the other hand, if the signal provided by the proximity sensor shows the possibility of fully and entirely occupied parking space, at that moment the PLC stops the main gate and shows NO space. inside for your car on display.

There is generally some point we are assuming in the future scope of our work. We did make a parking slot of capacity 20 cars at one particular place. This system ensures the safety of the luxury cars to occupy a better place for long time parking as well as short time and to reduce the problem of the traffic of vehicle simultaneously it will overcome accident too. we gotta move ahead with the implementation of multi-storage parking for reducing the lack of vacant land for installing the parking system and to increase the number of cars parking at one place. It will make for not only the safety of the driver but also to avoid collision between two cars to prevent a strike.

4. **Conclusion**

We have designed a car parking system that is reliable to use and ensures driver satisfaction. It provides good service at a low expenditure. The parking system based on PLC and HMI has been developed considering the real life problems faced while parking cars. It can be used ad public places where there are a number of visitors and most of them need a reliable place to park their vehicles. In future we would like to develop a multi level car parking system. Such systems will enable to park more number of cars in a limited space and would be useful at places where space is limited but the vehicle users are increasing rapidly.

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