

A LOW COST AUTOMATIC CAR PARKING LOT MANAGEMENT SYSTEM USING MOBILE PHONE AND EXTENSIBLE TO IOT

¹ M. Muralidhar, ² K. Praveen Kumar

¹Assoc. Professor, ²Assistant Professor

^{1,2}Department of ECE,

^{1,2}Narayana Engineering College, Nellore, India

Abstract : In today's resource crunching and time demanding of human lives Automation plays an important role of optimizing the usage of public entities such as Transport, Hospital, Government services to many. Through this paper we would wish to depict the design and development of A low cost Automatic Car parking lot management System using Mobile Phone. The same could be easily integrated to become an IoT hence it can be made suitable for a Smart City scenario.

The low cost Car Parking Application is developed using an Android mobile phone Application that serves as user friendly database for the easy access of available Parking lots at a Multipurpose Mall or Supermarket where customers want to drive-in with ease of parking and redeem of the vehicle being parked. In general, if the demand for parking lots is more than the availability it leads into congestion in walk around places and causes inconvenience to everyone at the Mall. A simpler low-cost Microcontroller based system having Bluetooth transceiver, Glue logic and Sensor to detect the empty parking lot is developed as a hardware unit that communicates and updates the Parking lot database on the Mobile phone. Also the system facilitates easy guidance to the driver of the car towards the empty parking lot through direction indicating lamps.

Keywords— Automation, Smart Cities, Parking Lots, Public Amenities Management.

I. INTRODUCTION

Automation facilitates ease of operating machinery, process control in factories, Control of Microwave ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or no human intervention. The major benefit of automation being it saves fatigue, human effort and better reusability of resources in demand. Also automation saves energy and materials and to improve quality, accuracy and precision. The Advent of VLSI made feasibility of simplification of Computing platforms and provides cost advantage on developing complex applications with low power stand by Batteries as source of energy for mobile Applications.

As a new wave of people flood cities to live, work and play, many arrive on four wheels cars, which are creating massive headaches for city planners and drivers. Smart cities are looking into reducing parking issues that cause street congestion and wasted time for drivers searching for spaces. Off-street parking isn't a solution: it is costly to build and takes space that could be used for other and imminent uses.

While some cities are looking into solutions such as parking prices that fluctuate based on demand to ensure a space is always available, others are revamping parking permit policies and updating zoning laws to allow for transit-oriented developments. Cities that aren't moving fast enough may soon be left in park. The demand for Parking lots become haphazardly high at times for example during festival breaks or an important sports event in the city and making it difficult to meet many loose ends of demands of various people in the society.

The handheld Mobile Phone is used as a platform for the user friendly access of database of car parking status(availability, tentative availability, reserved park etc). The driver arriving to the Parking lot will be directed towards the nearest parking lot on hitting the empty available slot highlighted in the List of the database, also the driver will be given a parking guidance through the lamps installed row and column wise Posts. Once the car is parked at the assigned lot, the sensor system automatically updates the database on the Mobile App. and access will be prevented by grey out of the lot in the Mobile Phone List. The sensor system using LDRs is designed for easy installation at the existing Parking lots using a low cost 8 bit microcontroller unit that has a glue logic constituting row decoder for guidance through lights and encoder for feedback to the Mobile. A Bluetooth Transceiver is used for to and fro communication with the Mobile Phone handled by the Parking supervisor.

II. LITERATURE

An Internet of Things (IoT) that incorporated transparently and seamlessly for a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Is being discussed in[1]. The concept of car parking detection mechanism using the ultrasonic sensor, in combination with the usage of Internet of Things on sending the status of the parking slot to the Internet is being discussed in [2]. A Model Free Adaptive Control for automatic car parking systems is being discussed in[3].

III. PROPOSED WORK

With this low cost Automatic Parking lot System the following functionalities are being envisaged for implementation and execution through a model development depicting the typical car parking scenario at a Shopping Mall.

1. An Android Mobile Application containing the schema of Car parking lot as database with functionalities such as
 - Indication of available lot through Green highlighted text in a list box
 - Communication facility to the transceiver module at the Parking through Bluetooth function
 - Grey out of occupied Lots through Grey color
2. A Microcontroller node with sensors interface to the Parking Lot constituting
 - Analog interface to LDR Sensor that detects presence or absence of the car in a Lot
 - Digital interface to the network of sensors through Encoder
 - Digital interface through a Decoder to the network of Lights that serve as Guidance to the driver towards an available parking Lot
 - A Bluetooth interface to communication port of the MCU with Bluetooth module HC-05
 - A wiring board with proper conduits to join the LDR sensors as well as Lamp wiring

Off the shelf 74LSxxxx ICs are used as Encoder and decoder circuits for the Hardware units. Arduinio Uno board is used as development system for developing the hardware for the Parking lot installation. A PCB with only required components and wiring mesh is developed for the final version.

The design is envisaged for an easy installation and with little maintenance. In case of failures the modular architecture is so designed for the easy replacement without the disturbance to the day to day operation of the Parking lot system. A demonstration module using a cardboard is developed for understanding the working of the System.

A) SYSTEM DESCRIPTION

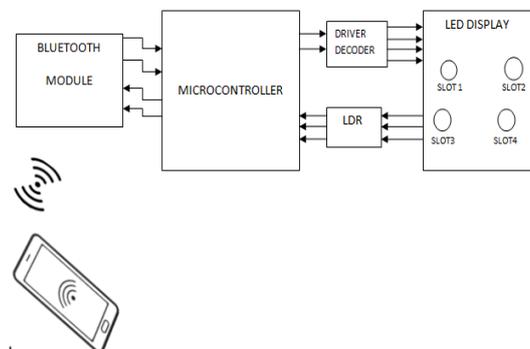


Fig 1. Block Diagram of Proposed System

The Mobile Phone communicates to the MCU through Bluetooth modules in order to get the status updates from various Parking Lots in the Mall Premises. This function is implemented as a separate thread for the automatic updating of the database. Driver decoders choose the respective row and column Lamps to guide the driver towards the Lot.

.A typical LED Connection Matrix through Decoder:

The decoder is used to optimize the usage of Digital Ports on the Arduinio with expansion for LED Matrix is done using the 74LS138 Line decoder.

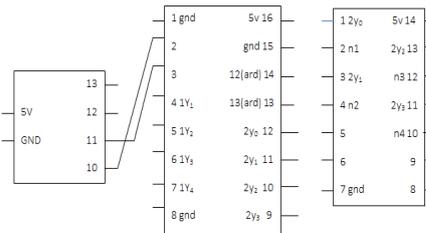


Fig 2: Guidance Light wiring Matrix

This saves cost and also use of only an 8-bit port for activating the guidance lamps.

Encoder Matrix for feedback sensors:

The feedback about the availability of Lot is detected through a LDR that makes use of Light available in the Lot for excitation. Obstruction by the parked car devoids the light falling on the sensor and an encoder is used to return the signal to Input port of the Arduino Processor.

B) SOFTWARE

A program for Arduino system is written in C programming language. sensing is employed in this project work. The Arduino project is developed in the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

The Program structure is that of a standard Arduino module coning A minimal Arduino C/C++ sketch, as seen by the Arduino IDE programmer, consist of only two functions.

setup: This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.

loop: After setup has been called, function loop is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

The 'setup' will have statements for initializing and configuring various IO ports in their required mode of operation. Also initialize various Global variable and timer information.

The 'loop' constitutes an ever running whiling loop having sequential enquiry on IO port status also obtaining Bluetooth communication message handling.

Android Studio:

Is used to develop the Mobile App for the phone constituting Message handling from Bluetooth interface for both Transmission of user selections on Parking lot as well as real time updates of the Parking Lots status. The user interface is developed as a simple list that gets automatically colored depending on the status of the Parking Lot.

Features that have been used for the Application development are:

- Gradle-based build support
- Android-specific refactoring and quick fixes
- Lint tools to catch performance, usability, version compatibility and other problems
- Built-in support for Google Cloud Platform, enabling integration with Google Cloud Messaging and App Engine
- An Android Virtual Device that is used to run and debug apps

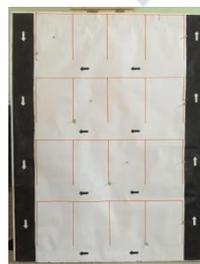
C) SYSTEM MERITS AND DEMERITS

MERITS

- Saves lot of time.
- Reduce the search effort.
- Less cost.
- Reduces pollution

DEMERITS

- Little hindrance to existing Lot



wiring.

PARKING LOT

IV. WORKING MODEL OF THE

Fig 4: Final Project model

The working Model developed has all the wiring Matrix and integrated Hardware board with the Battery Supply to work as an independent Module for easy demonstration.

The Project is developed as an Academic Project for the Partial fulfillment of Undergraduate study in Electronics Engineering stream at Authors Institution and was conceived and guided by the first Author as the supervisor to the student team and the second Author as the Project Coordinator from the department.

V. EXTENSTION TO IOT

The Project can be easily extended to the users from the city by giving interface through an Web Application Hosting. The Mobile Phone in turn would be used to access through the Browser rather than a dedicated App. Application features such as Parking lot reservation from home before reaching the premises of parking is being considered as an Application extension to the system.

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