SMART CAR PARKING SYSTEM USING ARDUINO

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ABSTRACT

Due to the proliferation in the number of the vehicles on the road, traffic problems are bound to exist. This is due to the fact that the current transportation infrastructure and car park facility developed are unable to cope with the influx of vehicles on the road.

To alleviate the aforementioned problems, the smart car parking system has been developed. With the implementation of the smart parking system, patrons can easily locate and secure a vacant parking space at any car parking dement convenient to them.

Subsequently, the various sensor systems used in developing the systems in addition to the recent research and commercial system on the market are examined as vehicle detection plays a crucial role in the smart parking system.

INTRODUCTION

In the recent years, a large number of new registered vehicles were reported compared to the previous years, which makes it a rough estimate of 54.5% increase in a span of 7 years (Malaysian Ministry of Transportation, 2007).

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Referring to the aforesaidstatistics provided by the Malaysian Ministry of Transportation, the current transportation infrastructure and car park facilities are deemed insufficient in sustaining the influx of vehicles on the road.

Therefore, problems such as traffic congestion and insufficient parking space inevitably crops up. In Asia, the situation are made worse by the fact that the roads are significantly narrower compared to the West (Inaba et al., 2001).
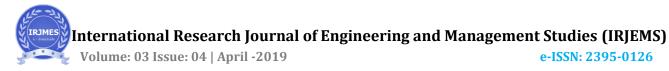
Various measures have been taken in the attempt to overcome the traffic problems. Although, the problem can be addressed via many methods, the paper focuses on the car park management system introduced, which is the smart parking system.

This study will review the evolution of vehicle detection technologies as well as the detection systems developed over the years.

THEORY OF THE PROJECT

ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read

inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing**.**

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller.

Figure 1 ARDUINO UNO

The 14 digital input/output pins can be used as input or output pins by using pinMode(), digitalRead() and digitalWrite() functions in arduino programming. Each pin operate at 5V and can provide or receive a maximum of

40mA current, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below:

Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.

External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function.

SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.

In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, it's off.

Along with 14 Digital pins, there are 6 analog input pins, each of which provide 10 bits of resolution, i.e. 1024 different values. They measure from 0 to 5 volts but this limit can be increased by using AREF pin with analog Reference() function.

Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library.

Communication

Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digitalpin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The ATmega16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. There are two RX and TX LEDs on the arduino board which will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (not for serial communication on pins 0 and 1). A SoftwareSerial library allows for serial communication on any of the Uno's digital pins. The ATmega328P also supports I2C (TWI) and SPI communication.

ii.

Digital Pins 11,12 & 13 are used by the ICSP header for MOSI, MISO, SCK connections (Atmega168 pins 17,18 & 19). Avoid low-impedance loads on these pins when using the ICSP header.

Figure 2 Arduino UNO To AtMega328 Mapping

INFRARED SENSOR (IR)

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, which can be detected by an infrared sensor.The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.
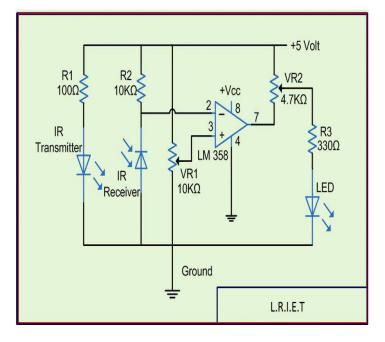
CIRCUIT DIAGRAM

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time.This circuit comprises of the following component:

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo ohms.
- Variable resistors.
- LED (Light Emitting Diode).

and planes, Robotics, Machine etc.

SERVO MOTOR

A **servo motor** is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through **servo mechanism**. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Doe to these features they are being used in many applications like toy car, RC helicopters

Figure 4SERVO MOTOR

.Servo motors are rated in kg/cm (kilogram per centimetre) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Wire Configuration

Wire Number	Wire Colour	Description
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor

WORKING OF A SERVO MOTOR

The Servo Motor basically consists of a DC Motor, a Gear system, a position sensor and a control circuit. The DC motors get powered from a battery and run at high speed and low torque. The Gear and shaft assembly connected to the DC motors lower this speed into sufficient speed and higher torque. The position sensor senses the position of the shaft from its definite position and feeds the information to the control circuit. The control circuit accordingly decodes the signals from the position sensor and compares the actual position of the motors with the desired position and accordingly controls the direction of rotation of the DC motor to get the required position. The Servo Motor generally requires DC supply of 4.8V to 6 V.
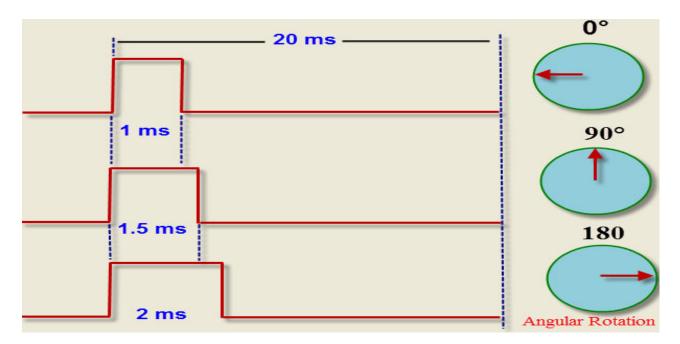

Figure 5 CONTROLLING A SERVO WITH ANGLE ROTATIONS

PROPOSED SYSTEM

The Proposed smart car parking system as the figure 9 explains based on smart gate and number of entrance and exit cars is shown in the sections below.
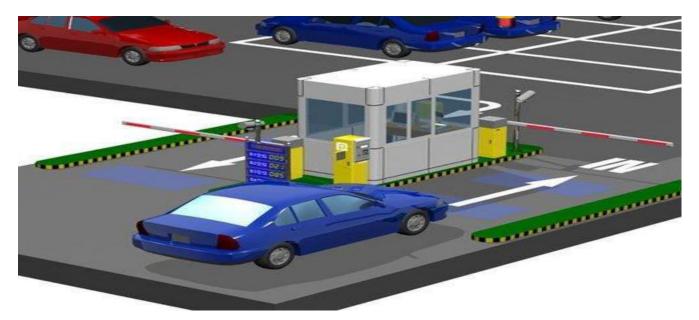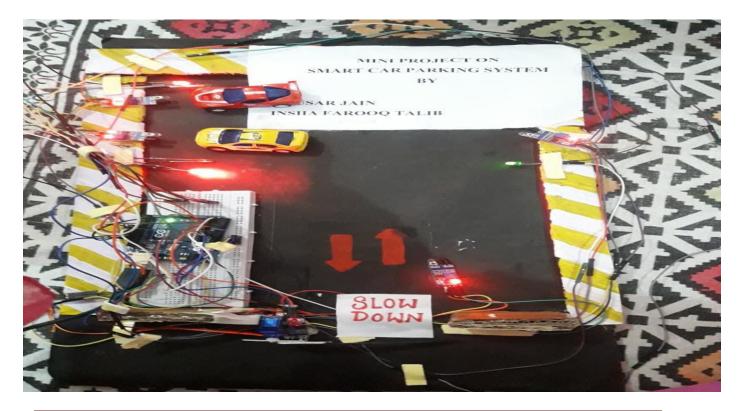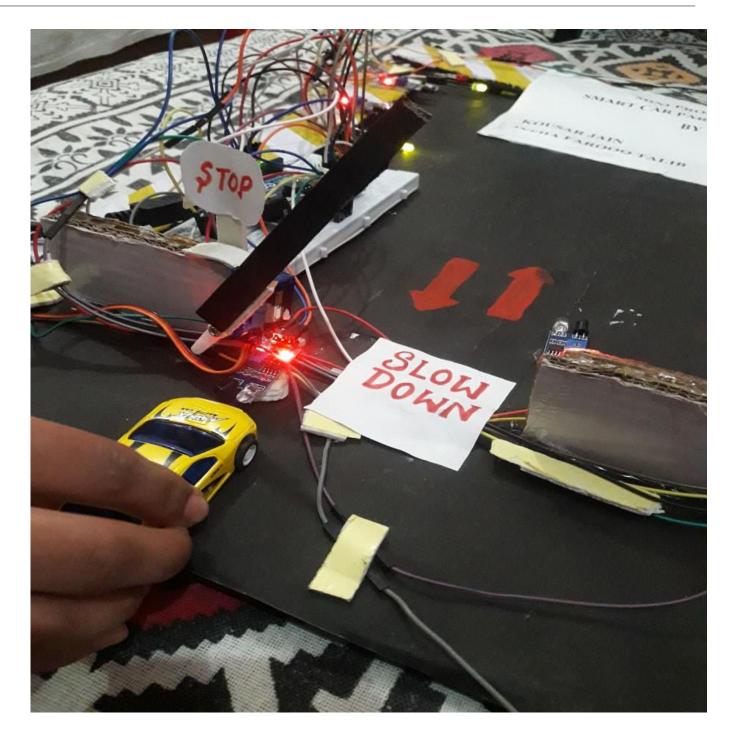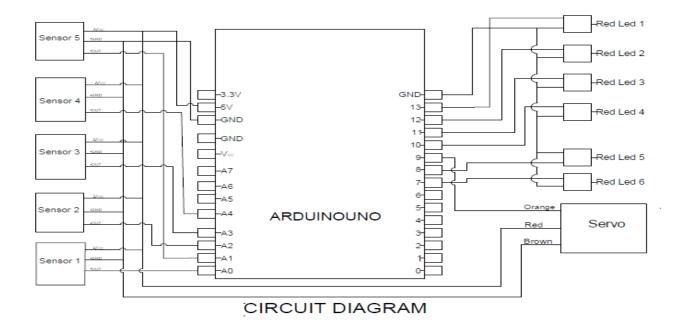

Figure 9SMART IMPLEMENTED PROJECT

I.   ELECTRONIC CIRCUIT

CIRCUIT DIAGRAM

CONCLUSIONS

In this study, the various types of smart parking system and has been presented. From the various examples of the implementation of the smart parking system being presented, its efficiency in alleviating the traffic problem that arises especially in the city area where traffic congestion and the insufficient parking spaces are undeniable. It does so by directing patrons and optimizing the use of parking spaces.

With the study on all the sensor technologies used in detecting vehicles, which are one of the most crucial parts of the smart parking system, the pros and cons of each sensor technologies can be analysed. Although, there are certain disadvantages in the implementation of visual based system in vehicle detection as described earlier, the advantages far outweighs its disadvantages.

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