Implementation of Four Wheeler Parking Management System

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Abstract:

In the proposed technique, an intelligent parking management system is designed. It depends on processing of an image captured in parking places. The flow of algorithm goes like identification of vehicle at parking slot, capturing the registration number of the vehicle, processing of an image, and reservation or booking the parking lot through IoT. An IR sensor is used to detect the presence of the car in parking lot. An ARM 11 processor is used for the data processing. Camera is placed at the entrance of the parking lot for capturing the objects detected at the parking place and the same is sent to the ARM processor.

The data base regarding the detected objects of the parking lot is updated every time and the data is shared through the IoT [10]. If we want to book the particular slot then we can get information of available slots in parking place through IoT. We can register the particular slot by selecting that particular slot number, so that we can park the car in that particular slot which we have registered. No other person can book already registered slot. The amount estimation for the time period during which the car is parked is also calculated. Information of the theft vehicle is sent to the police station whenever it enters the parking area.

I.INTODUCTION:

Now a day's finding the vacant space in highly developed parking cities is quite complicated especially during peak hours.

Because of this the driver may stuck in traffic or busy in finding parking slots in the parking region. A survey is telling that Thirty percent of the cars are in traffic jam are looking for finding the parking space which is wastage time and energy. We know that the parking spaces for airport/ multiplexes are large in size, so it is very difficult to maintain system physically. Moreover the manual management system has some disadvantages like time consuming, high cost, lack of security etc., In order to overcome these failures there is a need to develop smart parking system [5] which should maintain complete parking space information. If we know the parking slot data, we can register/book particular slot based on requirement in advance. So we have to develop a prototype which manages car parking area using IoT. The Internet of things (IoT) is the network of physical devices, vehicles, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data. The proposed vehicle parking management system contains IR sensors placed in the middle of all parking lots to sense the presence of car. The server processes the information regarding availability of number of lots and updates the database and the same data is uploaded onto web browser page.

The user can check vacant space and price from distantly through IoT [10]. It is a system that transmits and receives information over a network for managing the devices with or without human interaction. The data captured by sensors and transmit data through internet. The system also provides the collection of data, processing and data storage [1]. The proposed system helps driver to get the information regarding parking space availability through Internet of Things (IoT). The IoT keeps up the information of the parked vehicles through server. So drivers can register the spaces ahead of time and the parking data updated in server. Along with the parking management, theft management is also managed i.e. whenever a stolen vehicle enters the parking area then the information like registration number of car is verified with the list that is available in the database, if the data matches then a message / SMS is sent to the police. The amount estimation for the time period during which the car is parked is also calculated [4]. The automatic parking system was introduced in the year 1905 which is multi-story concrete structure with internal elevator to transport cars to upper levels where drivers park the car. After that there were many changes in the Automatic parking system has taken place like fully automated system where the robots parks the car and other is semi automated system the driver parks the car with some guide lines.
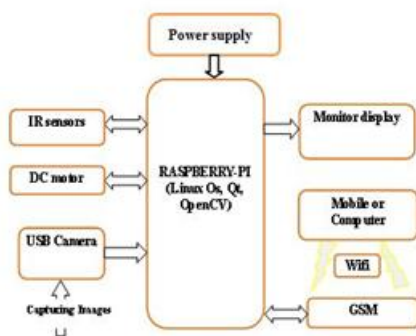
Block Diagram:

Figure 1: Block Diagram of the four wheeler parking management system.

The components of the four wheeler parking management system are as follows:

- An IR sensor detects the presence of the car. Along with IR sensor LED boards are placed in individual slot to tell the status of the slot whether it is busy, empty or booked.
- Camera is used for capturing the image of the car [3].
- Raspberry Pi which is the controller board with ARM 11 controller and it is installed with Linux OS. The complete image processing takes place with the open CV technology.
- Monitor Display to show the availability of the parking space and also gives the information whether the parking space is free, busy or booked.
- Mobile or pc is used to used to check whether the parking space is free, busy or booked and then after we can reserve the parking lot through IoT.
- Wi-Fi is used for updating the information regarding the parking area each and every time.
- DC Motor is used for opening or closing the gate whenever car is at the entrance of the parking area.
- GSM is used for sending the information regarding the theft vehicle to the registered police station number whenever any theft vehicle enters the parking area.
- The consoles keyboard and mouse are used in this system. These are helpful in entering the commands. These consoles are connected to the USB slots available.

II. SYSTEM MODEL:

In order to understand the implementation of the project first we have to understand about the 3 major modules that are used in different places.
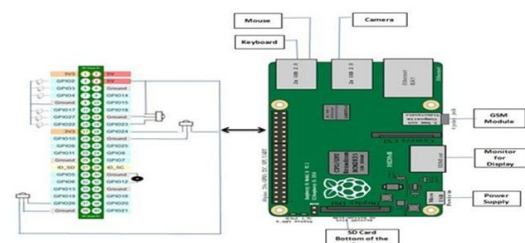

Figure 2: Schematic Diagram of the four wheeler parking management system.

First Module at the Individual Parking Slot:

- IR sensor circuit is used at each and every individual parking lot to detect the presence of the car.

Figure 3: IR Sensor Circuit

- Three LED's of RED, BLUE, GREEN colors are placed in the parking lot to indicate whether the parking lot is busy/empty/booked.
  - **RED**-Indicates the lot is busy.
  - **BLUE**-Indicates the lot is registered /booked.
  - **GREEN**-Tells the lot is empty

Figure 4: LED's

Second Module at the Main Entrance of the Parking Area:

- Here we place the IR sensor circuit to detect the entry of the car.
- USB camera is for capturing the ID on the plate of the car.
- Any kind of display like LCD, Monitor is used to show the details of the parking lot whether empty /busy/ booked.
- The data is forwarded to the server. The server operates the data and updates database and uploads onto browser.
- DC Motor is for opening/closing the gate of the parking lot entrance.

GSM Module:

Information of the theft vehicle is updated every time in the database so that if any theft vehicle comes to the parking lot then immediately the SMS containing the information of the theft vehicle is sent to police station using GSM Module.

Figure 5: GSM module

III.HARDWARE IMPLEMENTATION:

A. Raspberry Pi:

The Raspberry Pi[9] is a sort of small size PC that associates into our TV along with a keyboard. It is a capable little PC which can be utilized as a part of making projects, and for a great deal of things that the desktop Personal Computer does, similar to spreadsheets etc. It can play HD video. The name of Raspberry in **RASPBERRY PI** indicates the name of the fruit just like other companies APPLE, BLACK BERRY etc., and the word PI is from the Python language. It is a controller board which is equipped with all the ports that a PC has. The RPi was developed in the **RASPBERRY PI FOUNDATION** of UK. Eben Upton is the creator of **RASPBERRY PI** board.
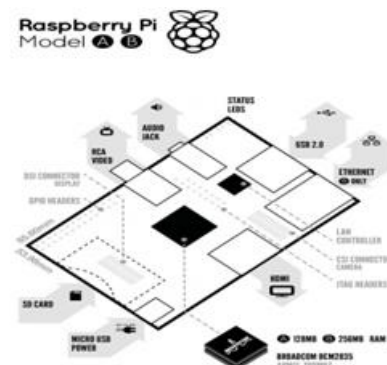

Figure 5: Raspberry Pi

The **Raspberry Pi** has a system on a chip (SoC) of Broadcom BCM2835, which is having an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was initially built with 256 MB of RAM, later on customized to 512 MB. It will not include a built-in hard disk, but an SD card is used for booting and constant storage. The Foundation is providing the Debian and Arch Linux ARM for download. Python is the major programming language for Tools, with support for BBC BASIC, C, Java and Perl.

B.TFT unit for Display:

TFT means Thin Film Transistor, which is a kind of technology used to enhance the quality of an image on LCD. Every pixel on a TFT-LCD has its individual transistor on the glass itself, which offers additional control over the pictures and colors that it provides. While TFT-LCDs have the ability to produce fine images, even though they are having relatively poor image viewing angles, that means they seem to be best when viewed head-on. When we view from side, it is difficult to perceive. TFT-LCDs take more power than any other types of displays.

C. UVC Driver Camera:

Figure 6: UVC Camera

A UVC [2] (or Universal Video Class) driver is a type of USB- driver. A driver is a device which enables webcam to communicate with the OS. And USB (or Universal Serial Bus) transfers data at high-speed. Almost all the current OS supports UVC.

There are 2 types of webcam device drivers:

1. First one is included along with the product. The driver should be installed first for the webcam to work correctly. It is specially tuned for webcam, which was designed by the manufacturer and for making effective use of webcam.

2. The other is UVC driver. We can only use one driver at a time, but other one will allow us to use webcam with various applications.

IV.SOFTWAREREQUIREMENTS

A. Linux Operating System:

Linux or GNU/Linux is a free or open source programming operational structure for PCs. The operational structure is an accumulation of the essential commands to assists components of the PC. Everybody has the flexibility to utilize it, perceive how it works, and changes it. There is a considerable measure of programming for Linux, and since Linux is free programming it implies that none of the product will put any permit limitations on clients. This is one reason why many individuals jump at the chance to utilize Linux. A Linux framework is a quiet Unix-like working framework. It deduces a lot of its critical plan from principles built up in UNIX midst of the 1980s. Such a structure uses a monolithic kernel, the Linux kernel looks after process control, system administration, and peripheral and file system access. Device drivers are either fused particularly with the part or included as modules stacked while the system is running.
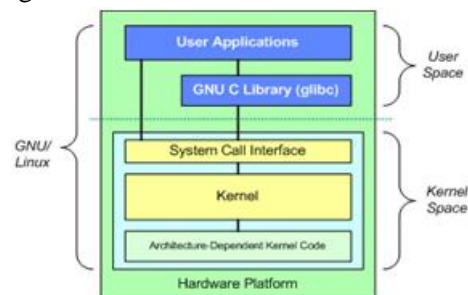

Figure 7: Architecture of Linux Operating System

Why Linux?

Some of the reasons for picking Linux over a conventional OS are as follows

• It is a free source and can be obtained very easily.

- It is having high security because any malware or virus can affect the properties of Linux so there is no need to install additional antivirus.
- Linux OS is compatible with all the low end computer distributions.
- Once we know how to use it then we feel it is very easy to use than any other OS.
- Linux kernel is provided with almost all the drivers so there is no need to install additional drivers.
- Linux OS is available with its own app store embedded with all libraries to run any application.

B. Qt for Embedded Linux:

Qt [7] is a cross-stage application system is broadly utilized for creating application software with a GUI. Furthermore it is utilized for creating non-GUI projects. Qt utilizes C++ however forms broad utilization of a unique code generator Known as Meta Object Compiler collectively with a macros to advance the language. It can likewise be utilized other software languages through bindings. Qt has increased association of enterprises support. Non-GUI highlights incorporate SQL database get to, XML parsing; string administration, arrange bolster, and a bound together cross-stage application programming interface (API) for record dealing with. GPL is free licensing software which provides licence for Qt framework. Generally the Qt is written in c++ and QML.

Qt depends on C++ so it can be effectively ported on to various stages, for example, Embedded Linux, Max OS X etc. It is open source and is utilized with an alternate client groups, discovering instructional exercises and the books you need would just take some time. Qt structure for implanted Linux additionally accompanies the particular window framework of its own, which composes straightforwardly to the Linux outline support, killing the requirement for the X11 windows framework. It is additionally accompanies diverse IDE's. It has bolstered for Eclipse, Network Bean. Client chooses IDE depending on their requirement.

C. OpenCV:

Open CV[8] (Open Source Computer Vision) is a general library of programming functions for real time computer vision. It was developed by Willow Garage, which is an organization of Robot Operating System (ROS). We know that MATLAB likewise can do Image Processing, at that point why we are choosing for open CV? In order to come out of that we have to look after the differences or the advantages between them.

Advantages of OpenCV over Matlab

- **Runtime:** Comparing to opencv the matlab programs are slower, because the open cv programs are written in c/c++.
- **Easy to learn:** As the open cv is built in c/c++ they are easier to learn while the matlab is built on java.
- **Interpretation**: The interpretation of the OpenCV programs is easy and fast as they are built on c.
- **Free of cost! :** Large parts of OpenCV are available for free .We can use OpenCV freely for running our commercial application, and can view the source and fix issues if required. Coming to the matlab it is of very high cost. The Basic matlab is of $2,150.
- **Huge optimized library:** All the algorithms are available in OpenCV for image processing. The library is also optimized for improving the performance.
- **Devices and Platforms:** We can use OpenCV in PC or as the backend of our web application. When coming to the point of performance OpenCV is the vision library of C/C++ choice which runs on many embedded/mobile applications.

V. IMPLEMENTATION OF THE SYSTEM
The following are the steps which describes how the **"Implementation of four wheeler parking space management system"**

- Initially we can detect the number of available lots whether busy or empty from the display at the entrance.
- If the user wishes to book the slot then using internet browser he can book the parking lot by giving the car plate number.
- The booking status of the car is displayed on the browser as well as on the display board at the entrance of the parking lot.
- If any car enters the parking area then the IR sensor circuit detects the car.
- Now the camera at the entrance of the parking area captures the image of the number plate. The image is processed using the OPENCV Technology [8].

The number of the processed image [6] is checked with the database available; here we come across with the three cases,

1. If the number is matching with booking status then the information is given to controller such that it opens the gate.
2. If the number is not matched with the booking status then the gate opens if and only if parking lot is empty.
3. If the number is matched with theft vehicle database then the gate does not open and the information is given to the police station.

After the car entered into parking lot then parking time of the car is calculated and the amount for the calculated time is displayed.

IV. RESULTS:

The four wheeler parking space management system was implemented and executed successfully by utilizing two parking areas, with three unique conditions of parking is busy/empty/booked. The framework is checked whether it is updated each and every time on vehicle entry and exit. Data of the stolen vehicle is informed to the specified number.

- Parking status is also shown in display. When any vehicle enters the camera captures the vehicle number then the processing of the image takes place [6].
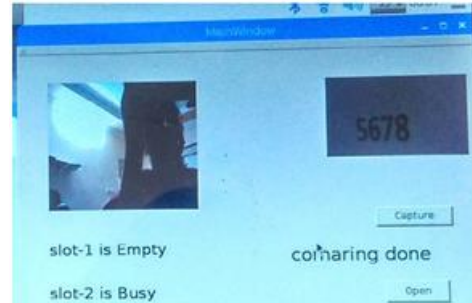

Figure 8: Image showing the status of parking area

- If the data match with theft vehicle then immediately the meassage is forwarded to the police officer.
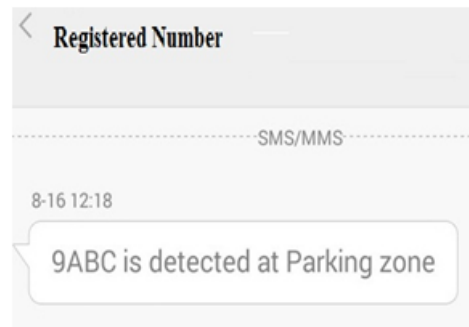

Figure 9: Message from GSM to registered mobile number

- Now the other task of the management system is to estimate the time and amount for that time during which the car is parked.
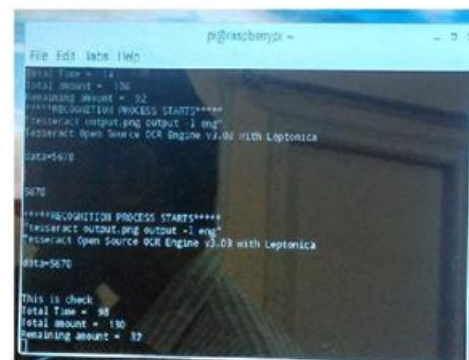

Figure 10: Time and amount estimation

V.CONCLUSION:

The main target of this prototype is to develop a car parking management system using Internet of Things. Now a day's everybody are using the smart phones and internet, so reserving / booking the particular parking lot online is considered as the best solution to reduce the wastage of time and fuel energy. Camera is used for detecting the car identity like number plate in a fraction of seconds and the major problem of theft vehicle recovery is also done. This prototype sends the messages regarding theft vehicle like the vehicle number through the internet to the mobile number of police officer available in the database. The parking management system provides best solution to the perfect car parking and reduces manual interaction. This system is efficiently employed in airports, corporate offices and multiplexes. Still it has some consequences, if number of parking lots increases controller cannot handle the system. For that wireless sensor networks needs to be replaced in order to make this system work more suitable, and we can design an android application and gather all the other parking spaces information in metropolitan areas we can also include that into the application.

VI. FUTURE SCOPE:

We can accomplish our project using web technologies and store data in the database. In future we can offer high security to the data by using encoding, decoding techniques.

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