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CNN and RNN Based Speed Bump Detection Model for Intelligent Vehicle System Using Raspberry pi

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ABSTRACT:

Country's economy depends on well-maintained roads as they are major means of transportation. It becomes essential to identify pothole and humps in order to avoid accidents and damages to the vehicles that is caused because of distress to drivers and also to save fuel consumption. This project aims design a robotic vehicle which can identifying the potholes, bumps, lane, sign boards, human being using image processing technology with the help of pi camera .The robot consist of GPS, voice module, to track the location of these path holes and bumps and send this location into the firebase database in the form of latitude and longitude values through Wi-Fi. The robot consists of voice module to provide voice alerts through speaker. The robot consists of GSM module send the alert message to the predefined mobile number. So the respective person can take action of maintaining the roads and help the drivers from accidents.

Keywords:

Raspberry pi3, GSM. GPS, SD card, Pi camera. L293d motor driver, DC motor.Apr33a3 voice module, LCD display.

1. INTRODUCTION:

Artificial intelligence in vision based approaches has proven to be effective in various phases of intelligent vehicle system (IVS).

The human being detection using image processing and pi camera the electronics system alerts the vehicle about the human and then vehicle stop automatically and hence avoid the accidents. The alert is provided in the form of voice through speakers.

The lane detection also using image processing, pi camera the electric vehicle follow the lane and moves accordingly. If the sign boards detected by the vehicle then system give the alerts through voice using speaker.

The SD card is a key part of the Raspberry Pi; it provides the initial storage for the Operating System and files. Storage can be extended through many types of USB connected peripherals. The machine learning algorithm, TENSOR FLOW, open CV is used with some predictions along with designed project to improve the performance.

2. LITERATURE SURVEY:

In previous work the speed bumps are detected using accelerator meter and GPS. Add in few, research on speed bump detection was also carried using LIDAR and IR detected.

Mohit Jain, Ajeet Pal Singh, Sushant Bali, SanjitKaul, "Speed-Breaker Early Warning System: This paper gives the overview and detection of speed bumps using accelerometer.

R. Fernande, Junyoung Lee, Dongwook Kim, Giacomo Soprani, Pietro Cerri, Alberto Broggi, "Environment-Detection-and-Mapping Algorithm for Autonomous Driving in Rural or Off-Road Environment", and IEEE Transactions on Intelligent Transportation Systems, Vol. 13, No. 2, June 2012: In this project, Environment-detection-and mapping algorithms have been designed lane, pedestrian crossing, speed-bump detection algorithms and obstacle detection algorithm using LIDARs.

In [2] author proposed "Lane Detection Method with Impulse Radio Ultra-Wideband Radar and Metal Lane Reflectors " a lane detection method that uses an impulse radio ultra-wide band radar with high- range resolution and metal lane markers installed at regular intervals on the road. Lane detection and departure is realized upon using the periodically reflected signals as well as vehicle speed data as inputs. For verification, a field test was conducted by attaching radar to a vehicle and installing metal lane markers on the road. Experimental scenarios were established by varying the position and movement of the vehicle, and it was demonstrated that the proposed method enables lane detection based on the data measured.

3. IMPLEMENTATION:

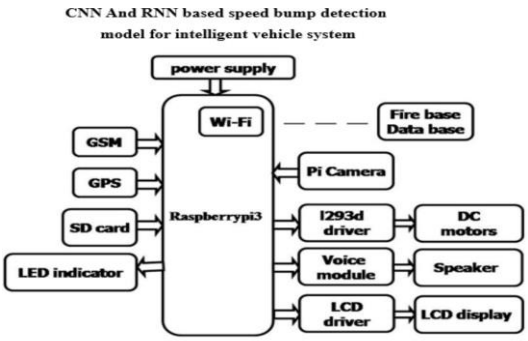

Fig:3.1 Block Diagram of Speed Bump Detection Model

The main controlling device of the project is raspberry pi3 processor. This system uses CNN(Convolutional Neural Network) and RNN (Recurrent neural network) is deep learning algorithm which is used to detects the real time the potholes, bumps, lane, sign boards, human being. The Raspberry Pi has a dedicated camera input port that allows users high-resolution photos. Using Python and specific libraries written for the Pi, users can create tools that take photos and video, and analyze them in real-time or save them for later processing.

DC motor along with motor driver is interfaced to the raspberry pi processor. The pi camera takes the inputs from dataset and it will give to the raspberry pi processor. The dataset consist of more images which is identify by pi camera like bumps, lane, and sign boards, human. Based on input the processor control the robot accordingly and give the voice alert through speaker and track the location from GPS and sensing the message through GSM and also monitor the project status on LCD.

4. RELATED WORK:

The brief introduction of different modules used in this project is discussed below:

4.1. Raspberrypi3:

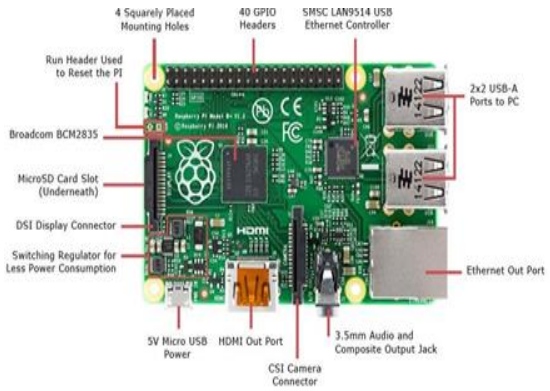

Fig: 4.1 Raspberry pi3

Credit card size computer, HDMI, Ethernet & 4 USB ports, 1GB RAM, Micro SD Socket, 40 GPIO, Raspberry Pi 3 Featuring the ARM1176JZF-S Running at 1.2 Ghz, with 1 GB of RAM .The RASPBERRY Pi 3 is a credit card sized computer that plugs into your TV and a keyboard, it's like a little PC which can be used for many of the things that your desktop PC does, like spreadsheets, word processing and games. It also plays high definition video. The design is based around a Broadcom BCM2837 SoC, which includes an ARM1176JZF-S 1.2 Ghz processor, VideoCore IV GPU and 1 GB RAM. The design does not include a built in hard disk or solid state drive, instead relying on a microSD card for booting and long term storage. This board is intended to run Linux kernel based operating systems.

4.2. Rechargeable Battery:

Fig: 4.2 Battery

A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. In this project we presents a 12v chargeable battery to run the robot.

4.3. Pi camera:

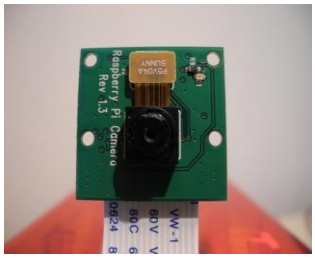

Fig: 4.3 Pi camera

The camera consists of a small (25mm by 20mm by 9mm) circuit board, which connects to the Raspberry Pi's Camera Serial Interface (CSI) bus connector via a flexible ribbon cable. The camera's image sensor has a native resolution of five megapixels and has a fixed focus lens. The software for the camera supports full resolution still images u p to 2592x1944 and video resolutions of 1080p30, 720p60 and 640x480p60/90.

4.4 Voice module:

Fig : 4.4 APR33A3 Voice module

The aPR33A series C2.0 is specially designed for simple key trigger, user can record and playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch, It is suitable in simple interface or need to limit the length of single message, e.g. toys, leave messages system, answering machine etc. Meanwhile, this mode provides the power- management system. Users can let the chip enter power-down mode when unused. It can effectively reduce electric

current consuming to 15uA and increase the using time in any projects powered by batteries.

4.5 DC motor with L293 motor driver

Fig: 4.5 DC motor

A DC motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The reverse process, producing electrical energy from mechanical energy is accomplished by an alternator, generator or dynamo. Many types of electric motors can be run as generators, and vice versa. The input of a DC motor is current/voltage and its output is torque (speed).

4.5.1 L293d motor driver:

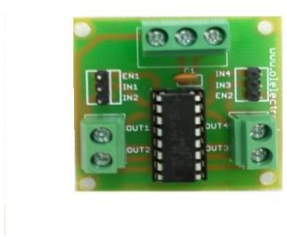

Fig :4.5.1 Motor driver

The **L293D** is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single **L293D** IC is capable of running two DC motors at the same time; also the direction of these two motors can be controlled independently.

4.6 GSM:

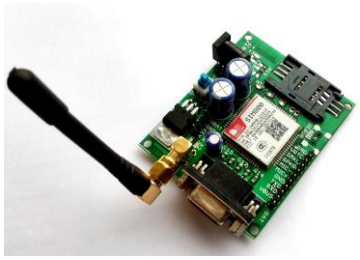

Fig:4.6 GSM

GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. In this paper presents a sim900A GSM module. GSM module works with AT commands for sending message.

4.7 GPS:

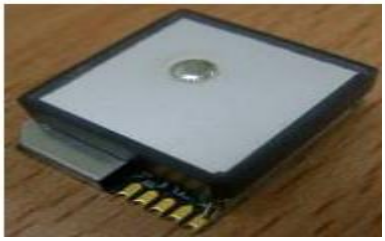

Fig:4.7 GPS

The global position satellite system (GPS) has revolutionized navigation and position location. GPS satellites broadcast signals from space that GPS receivers use to provide three-dimensional location (latitude, longitude, and altitude) plus precise time. Three satellites might seem enough to solve for position, since space has three dimensions and a position on the Earth's surface can be assumed. However, even a very small clock error multiplied by the very large speed of light the speed at which satellite signals propagate results in a large positional error. Therefore receivers use four or more satellites to solve for the receiver's location and time. The very accurately computed time is effectively hidden by most GPS applications, which use only the location.

4.8 LCD display:

Fig: 4.8 LCD Display

One of the most common devices attached to a micro controller is an LCD display. This project presents a 16*2 LCD means 16 characters per line by 2 lines respectively.

The status of the project will display on LCD module.

5. CONCLUSION:

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

The project was designed a system which captures the image which is placed in front of camera and reads out the text, and also the text messages from Bluetooth module using voice messages from speaker or head phones to blind persons.

6. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future..

7. RESULTS:

The proposed setup has been developed and is similar to real time scenario with the following concerns like:

a. The functional prototype modifies its driving decision when it detects speed bump object,

b. Different categories of speed bumps are considered, and

c. The regulation of vehicle's speed is controlled through Raspberry Pi and embedded vision sensors.

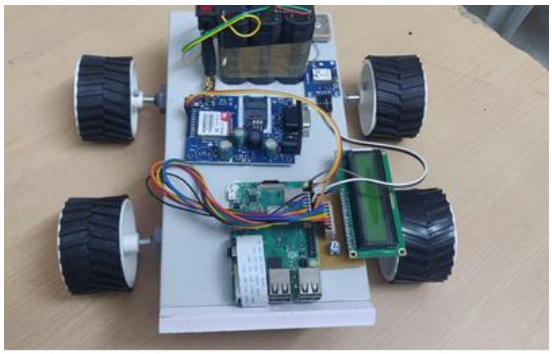

Fig: 7.1 Intelligent vehicle system

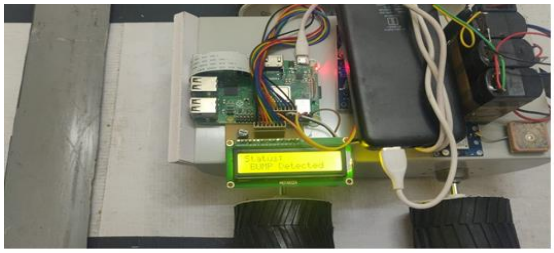

Fig: 7.2 Real time detection of speed bump

Fig: 7.3 Real Time Detection for Human

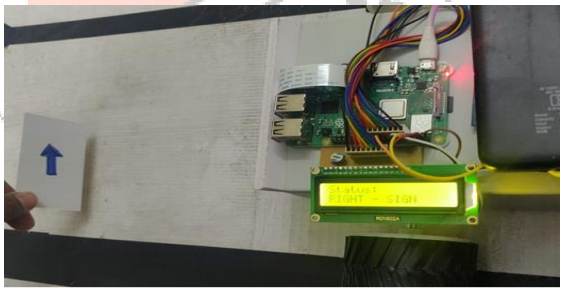

Fig: 7.4 Real time detection for sign board

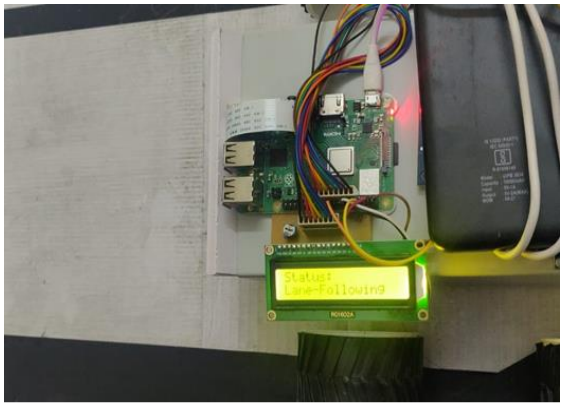

Fig: 7.5 Real time detection fort line

Fig: 7.6 Uploading the data into the firebase database

Fig: 7.7 Detecting the latitudes and longitudes values and displaying on LCD

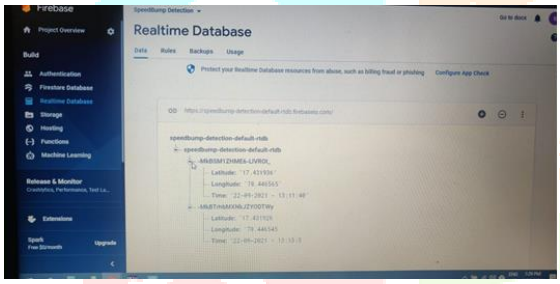

Fig: 7.8 latitudes and longitudes values of speed bumps and lanes in real time data base.

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