Smart System for Next Generation Automobile Technology

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Abstract— In a country like India where the population has crossed 125 billion. And with that the usage of vehicles and traffic has increased. Due to the increase in the traffic, the instances of accident are rising tremendously. Now for detecting the accidents a system was introduced in many cars by the automobile companies, but this facility was given in the cars with the higher price band, which is not affordable by all people. A new plan has been implemented in this report where this system will work globally with help of the IoT through an amazon web services. Sensors like Ultrasonic sensor and RFID will sense the different aspects and send it to the Raspberry Pi and the data will be stored locally in the memory card on the Raspberry Pi. The Ultrasonic sensor is used to determine the approximate distance from the vehicle to any obstacle like tree road divider, other vehicle or anything that can cause accident. If accident is detected then GSM module send the exact location with Latitude and longitude of the Car with help of the GPS module to the number which we had defined and also to the emergency Service for accident like 108. The data, which was sensed and recorded by the sensors, are sent to the Amazon cloud where this data will stored, visible and analysed globally from anywhere in the world. Finally, the data will be displayed to the user on a web page. With this type of prototype implemented in cars with lower price the facility of accident, detection will be available to many people who were first not able to purchase the costly cars.

Key words: GPS, GSM, Raspberry pi, Ultrasonic Sensor, RFID sensor

I. INTRODUCTION

As far as automobile industry is concerned, a wide range of industries and companies are involved in the development, designing manufacturing and selling of cars, bikes, buses, etc. India represents one of the world's largest automobile markets. From the past few years, even the middle-class has started showing interest in buying a vast range of cars or vehicles. The growth of the Indian automobile industry has recorded tremendous potential over the years. The industry's financial record is almost 7% of the country's gross domestic product and both directly or indirectly, automobile industry employs about 19 million people. Moreover, with the government support and a special focus on exports of two and three wheelers, small cars, auto components and multi-utility vehicles, the automobile industry produced 1.73 million vehicles in February 2013 alone including commercial, two wheeler and three wheeler vehicles and passenger vehicles as well. In February 2014, the industry produced 1.81 million vehicles. An advanced embedded system in automobiles has increased rapidly in the past two decades. Every year automobile manufacturers pack embedded systems into their cars for different functionalities like

Ignition, security and audio systems. The technological innovations of the embedded system within the vehicle are being ambitiously challenged to make the vehicle energy efficient, network perceptive and safer. In 1968, the Volkswagen used first embedded system in the automobile industry. With the development and applications of many embedded techniques, car security, system design and analyses are constantly improving. Many new techniques, such as biometric recognition technique, image-processing technique, communication technique and so on, have been integrated into car security systems. At the same time, the amount of accident of cars remains high, specially, lost. Therefore, one practicable car security system should be efficient, robust and reliable.

II. WHAT IS IOT?

For the Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The Internet of Things may be a hot topic in the industry but it's not a new concept.

In the early 2000's, Kevin Ashton was laying the groundwork for what would become the Internet of Things (IoT) at MIT's AutoID lab. Ashton was one of the pioneers who conceived this notion as he searched for ways that Proctor & Gamble could improve its business by linking RFID information to the Internet. The concept was simple but powerful. If all objects in daily life were equipped with identifiers and wireless connectivity, these objects could be communicate with each other and be managed by computers. In a 1999 article for the RFID Journal Ashton wrote: "If we had computers that knew everything there was to know about things—using data they gathered without any help from us -- we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best. We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. RFID and sensor technology enable computers to observe identify and understand the world—without the limitations of human-entered data." Today, many of these obstacles have been solved. The size and cost of wireless radios has dropped tremendously. IPv6 allows us to assign a communications address to billions of devices. Electronics companies are building Wi-Fi and cellular wireless connectivity into a wide range of devices. ABI Research estimates over five billion wireless chips will ship in 2013.2 Mobile data coverage has improved significantly with many networks offering broadband speeds. While not perfect, battery technology has improved and solar recharging has been built into numerous devices. There will be billions of objects connecting to the network with the next several years. For example, Cisco's Internet of Things Group (IOTG) predicts there will be over 50 billion connected devices by 2020. [1] So Internet of Things or IoT is connecting Embedded System to internet.

III. SYSTEM COMPONENTS

A. Raspberry Pi:

The Raspberry Pi is a small, powerful and lightweight ARM based computer, which can do it ideal for multimedia applications such as media centres and narrowcasting solutions. The Raspberry Pi is based on a Broadcom BCM2836 chip. It does not feature a built-in hard disk or solid-state drive, instead relying on an SD card for booting and long-term storage. The Raspberry Pi is a credit card sized computer based on a proprietary Broadcom processor that includes a 700 MHz ARM11 processor. The 'B' Model of the Pi 2 has 1 GB of on board RAM and 4 USB ports, 40 pin extended GPIO as well as on board video, audio and Ethernet adapters. Its "hard drive" is any standard (4 GB or larger) SD card, which plugs into the on board SD card socket. You power it with 5 volts, typically from a standard

The 'B' model costs $35. The somewhat less powerful 'A' model (256MB of RAM, 1 USB port, no Ethernet) costs $25. It is designed to run Linux, most commonly a variant of Debian that is called "Wheezy". The standard Wheezy distribution contains both a command line and a GUI user interface. The processor at the heart of the Raspberry Pi system is a BroadcomBCM2836 system-on-chip (SoC) multimedia processor. This means that the vast majority of the system's components, including its central and graphics processing units along with the audio and communications hardware, are built onto that single component hidden beneath the 256 MB memory chip at the centre of the board

B. Gsm Module:

GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL – Modem is SIM900 Quad-band GSM / GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600- 115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication).

Features:

- Quad Band GSM/GPRS : 850 / 900 / 1800 / 1900 MHz
- Built in RS232 to TTL or viceversa Logic Converter (MAX232)
- Configurable Baud Rate • SMA (SubMiniature version A) connector with GSM L Type Antenna
- Built in SIM (Subscriber Identity Module) Card holder
- Built in Network Status LED
- Inbuilt Powerful TCP / IP (Transfer Control Protocol / Internet Protocol) stack for Internet data transfer through GPRS (General Packet Radio Service)
- Audio Interface Connectors (Audio in and Audio out)
- Most Status and controlling pins are available
- Normal Operation Temperature: -20 °C to +55 °C
- Input Voltage: 5V to 12V DC • LDB9 connector (Serial Port) provided for easy interfacing

C. Gps Module:

The SKG13BL is a complete GPS engine module that features super sensitivity, ultra-low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol. It is based on the high performance features of the MediaTek MT3337 single-chip architecture, its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

D. RFID Sensor and RFID Tag:

This board is based on the EM-18 RFID Module. Using the board with microcontrollers to read a card's data is very simple and requires just a serial connection. The board has a bridge rectifier and 5V voltage regulator so it can be powered by 9~12V AC as well as 9~15V DC adaptor. Module can also be powered through header wires (+5V & GND) from other interfacing board. The board has an onboard power switch (Labeled PWR SW), power indication LED (Labeled PWR) and to indicate the detection of Card/Tag, it has a LED (Labelled DTCT) and Buzzer.

E. Ultrasonic Sensor:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

Using IO trigger for at least 10us high-level signal, 2. The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. 3. IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high-level time × velocity of sound (340M/S) / 2.

IV. SYSTEM COMPONENTS

A. IoT and Its Protocol:

Simply put this is the concept of connecting any device with an on and off switch to the Internet (and/or to each other). This includes everything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and almost anything else you can think of. This also applies to components of machines, for example a jet engine of an airplane or the drill of an oilrig. As I mentioned, if it has an on and off switch then chances are it can be a part of the IoT. The analyst firm Gartner says that by 2020 there will be over 26 billion connected devices…that is a lot of connections (some even estimate this number to be much higher, over 100 billion). The IoT is a giant network of connected "things" (which also includes people). The relationship will be between people-people, people-things, and things-things.

Protocol	CoAP	XMPP	Restful HTTP	MQTT
Transport	UDP	TCP	TCP	TCP
Messaging	Request/ Response	Publish/Subscribe Request/Response	Request /Response	Publish/Subscribe Request/Response
2G, 3G, 4G Suitability (1000s nodes)	Excellent	Excellent	Excellent	Excellent
LLN Suitability (1000s nodes)	Excellent	Fair	Fair	Fair
Compute Resources	10Ks RAM/Flash	10Ks RAM/Flash	10Ks RAM/Flash	10Ks RAM/Flash
Success Stories	Utility Field Area Networks	Remote management of consumer white goods	Smart Energy Profile 2 (premise energy management,home services)	Extending enterprise messaging into IoT applications

Table 1: comparison of IoT protocol

B. Amazon Ec2 Cloud:

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) cloud. Using Amazon EC2 eliminates your need to invest in hardware up front, so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. Amazon EC2 enables you to scale up or down to handle changes in requirements or spikes in popularity, reducing your need to forecast traffic.

Features of Amazon EC2

Amazon EC2 provides the following features:

- Virtual computing environments, known as instances
- Preconfigured templates for your instances, known as Amazon Machine Images (AMIs), that package the bits you need for your server (including the operating system and additional software)
- Various configurations of CPU, memory, storage, and networking capacity for your instances, known as instance types
- Secure login information for your instances using key pairs (AWS stores the public key, and you store the private key in a secure place)
- Storage volumes for temporary data that's deleted when you stop or terminate your instance, known as instance store volumes
- Persistent storage volumes for your data using Amazon Elastic Block Store (Amazon EBS), known as Amazon EBS volumes.

V. PROPOSED SYSTEM

Sensors like Ultrasonic sensor and RFID will sense the different aspects and send it to the Raspberry Pi and the data will be stored locally in the memory card on the Raspberry Pi. The Ultrasonic sensor is used to determine the approximate distance from the vehicle to any obstacle like tree road divider, other vehicle or anything that can cause accident. If accident is detected then GSM module send the exact location with Latitude and longitude of the Car with help of the GPS module to the number which we had defined and also to the emergency Service for accident like 108. The data, which was sensed and recorded by the sensors, are sent to the Amazon cloud where this data will stored, visible and analysed globally from anywhere in the world. Finally, the data will be displayed to the user on a web page.

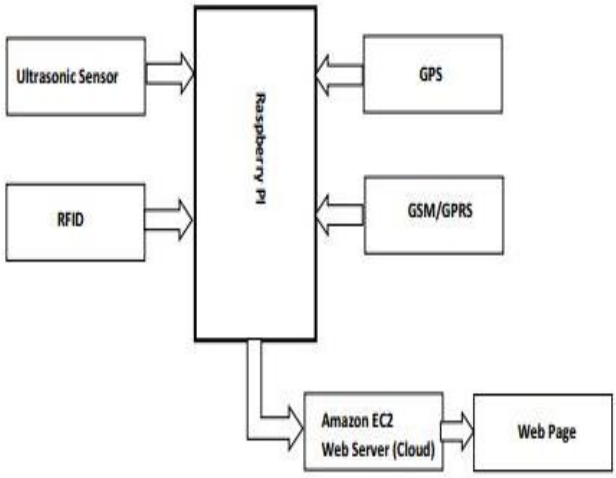

Fig. 1: Block Diagram of Proposed System

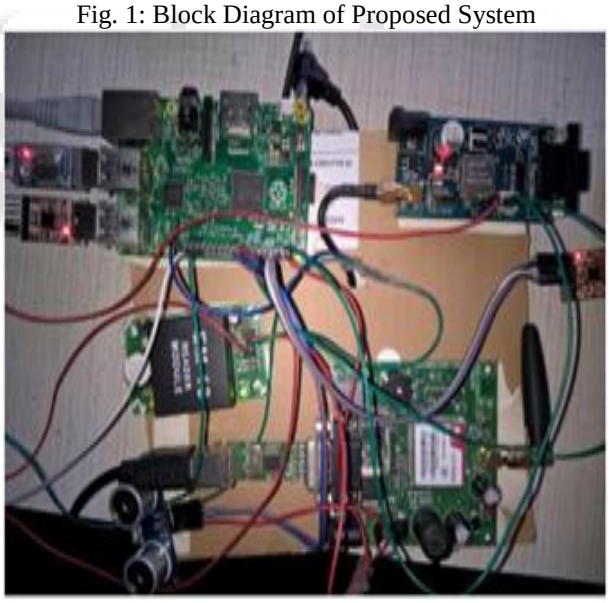

Fig. 2: Overall implementation of Prototype

This figure shows the prototype of the Sensors are interfaced with the GPS, Raspberry Pi and the GSM modules.

Fig. 3: Car door status

This Figure shows the putty softwre in which we can see the output of the RFID module. If the RFID card is read by the car then the status of the door will be shown open or else close in the putty software.

Fig. 4: GPS co-ordinates using minicom

Here we can see the Co-ordinates using the minicom software which we install in the Raspberry Pi. The GPS will show the exact location with the help of Co-ordinates.

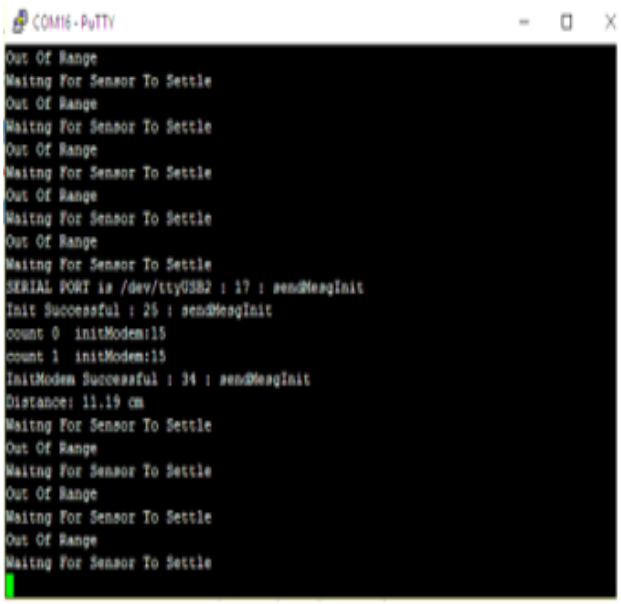

Fig. 5: Ultrasonic Sensor Data

The Ultrasonic sensor continously detects the obstacle distance once the obstacle is detected within the range which is not permissble. It will trigger the GSM and send an SMS the Co-ordinates to the registered number and Emergency services.

Fig. 6: Webpage

This figure shows the Web Page that is created using PHP programming. This is the Login Page where after login we can see the data of the accident detected.

VI. CONCLUSIONS & FUTURE SCOPE

Finally, a prototype is created which helps in detecting accidents. The prototype consist of Raspberry pi on which all other modules and sensors are interfaced, GSM Module which will send a SMS to a registered number, GPS Module will locate the co-ordinates if ultrasonic Sensor sense an obstacle, RFID Module is used for security purpose. The overall prototype will help to let emergency services and family members know about the accident and the place where it occurred.

The future scope of this work is that we can make a database where all the data will be stored. After some years

with the help of this data, we can know the areas, which are extremely prone to accident. By knowing this necessary prevention steps can be taken regarding that areas. Due to this chances of emergency services reaching late to the place where accident took place will be less.

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