International Journal of Scientific & Engineering Research, Volume 6, Issue 3, March-2015
ISSN 2229-5518

IoT: To Enhance Automatic Accident Notifications Using M2M Technologies

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Abstract— Traffic accidents are one of the leading causes of victims all over the world. The level of treatment or first-aid received at the accident spot is very low. Hence, an important indicator for survival rates after an accident is the time between the occurrence of accidents and dispatching time of emergency medical personnel to the accident spot. Recently, Internet of Things (IoT) plays the major part in communication technologies, among which M2M application services is considered an integral part. However it brings several benefits to industries around the world and has a wide range of applications such as logistics of data analytics, Smart grid sensor, Health monitoring etc. As a result, IoT can be integrated to monitor automatic accident notifications. The proposed system requires each vehicle to be endowed with M2M device in On-Board Unit of vehicle, which is responsible for detecting the location of accident, estimating the severity of accidents and reporting accident situations to an M2M server application using the wireless technology. Then M2M server is responsible for allocating the necessary resources for the rescue operation and sharing the information to other M2M devices to give the victims a better chance and resources for survival, using Lightweight M2M standards protocols. As a result, our system could notably reduce the time needed to alert and deploy the emergency services after an accident took place.

Keywords—: Cloud, IoT, M2M, OBU, VANET, Wireless Sensors Networks, ZigBee.

1 INTRODUCTION

In day todays life's, tremendous road accidents are occurred. In that most peoples are died because of they don't occurred proper rescue resources at that time. Now a days M2M technology going to be a one of the main part of IOT, Which means device can communicating automatically without human interaction as known as intelligent M2M technology. Probably many industrial fields are acquiring M2M technology because of it communicates faster and also more robust of data transfer solutions using standard technologies. M2M works with various enables technologies as (GSM, ZIGBEE etc.) Prerequisites for M2M components consist of 1) sensors, 2) computers, servers and software's and 3) communication networks. Among all, communication network (internet/ cellular network) plays major role in IoT of cloud M2M technologies. Sensors are simply gathering the information and transmit that information of data to server and other M2M devices using communication network. In server side, receive the data from remote device and preceded appropriated decision; finally send the processes of data to M2M rescue devices using communication networks.

In this paper, it shows that to increase the overall rescue process of road accidents using LWM2M constrained protocol stack between M2M devices. M2M application is installed both M2M server and M2M client. M2M is placed in On-Board Unit of in-vehicle system and M2M server application is being processed over cloud, which is performed in an intelligent manner.

The summary of this paper is described as follows: Section 2 discussing the related works. Section 3 follows the system architecture of accident notification. Section 4 describes the Experimental Results and finally section 5 describes conclusion.

2 RELATED WORKS

A recent study shows that, Manuel Fogue et al [1]. Describes the new communication technologies are integrated into modern vehicle and offers the better assistance to peoples who injured in accidents based on estimating the severity of accidents. Luigi Atzori et al [2] shows IoT enabled various communication technologies, informatics and electronics. Identifying and tracking the smart sensing objects in wired and wireless technologies. M2M technology is based on intelligent system, which takes decision automatically without human intervention. The M2M device consists of various embedded sensor, actuators and wireless communication modules [3].

In [4], [5] authors propose that various sensing objects are stored virtually into public cloud and providing security to that objects, namely Trustworthy of Sensing of Cloud Management (TSCM). To reduced delay and improve the message transformation using REST approach, which focus into CoAP and EXI.

3 SYSTEM ARCHITECTURE

A complete system has been developed as notification of accident to nearby devices and cloud control unit server using M2M technology.

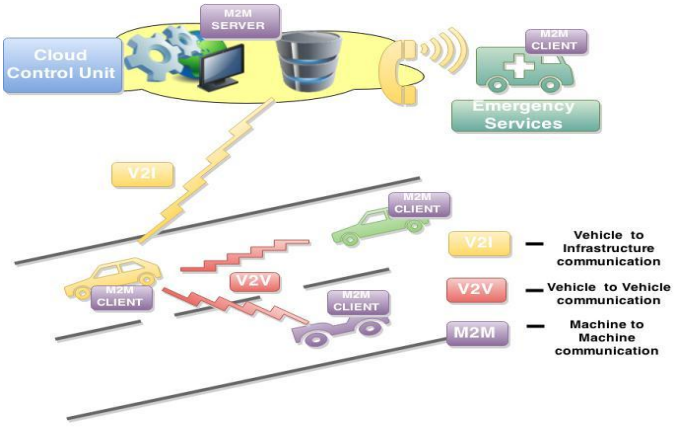

Fig1.System Architecture

VANET communication technologies are integrated in ITS (Intelligent Transport system), which communication has taken place between V2V and V2I. Hence combination of V2V and V2I named as hybrid communication, which gives better assistance to peoples. M2M application is installed into both M2M client and M2M server. M2M client is known as M2M device, which is placed in On-Board Unit of vehicle system. If any accident occurred in OBU vehicle, automatically send warning messages to other M2M client vehicle and M2M server of cloud Control Unit using IoT web services of stack protocol. In CCU (Cloud Control Unit), automatically stored warning messages into accident database and providing rescue resources like emergency service based on severity of accident.

3.1 Accident Notification for M2M

In-Vehicle System of OBU, which is lies in between the vehicle. On-Board Unit is combination of embedded system; such as microcontroller, sensor, GPS module and ZigBee IEEE 802.15.4 communication standards and it is interacted with M2M application for sharing messages to other M2M devices. When an accident occurred in vehicle, automatically categories the severity of accident like major, minor and moderate based on motion of the sensor. And identified the position of vehicle using GPS receiver along with pretended the vehicle speed. Finally, collect all information of messages into one warning messages and send those warning packet into cloud resources and other vehicles for providing better assessment to people who injured in accident via web services of IoT using LWM2M protocols.

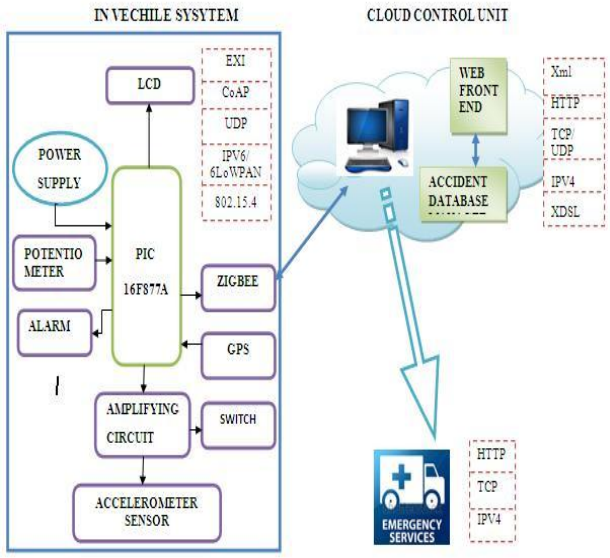

Fig2.Architecture of M2M

LWM2M is acronym for Light-Weight Machine to Machine; it's particularly designed to manage the low-cost and more constrained device. The constrained device guaranteeing the low complexity access and interoperability among IoT nodes, which is consists of various constrained protocol stacks such as Constrained Application Protocol (CoAP), Efficient XML Interchange (EXI) and 6LoWAP. Web service of constrained protocol stacks are promoted by international standards bodies such as IETF, ETSI and W3C.

In a constrained protocol stacks contain various functionality layers, they are 1) Network layer, 2) Transport and application layer, 3) Data.

3.1.1 Network layer

IoT is connected trillions of nodes around the world, such as transportations, health monitoring and wires sensor nodes each one is addressing into unique. IPV6 deployed to overcome the various addressing issue in IoT and adopting the 6LoWPAN for insufficient of constrained networks. LoWPAN consumes low-power and lower data bandwidth and it's used to sharing the messages into IPV6 protocol to IPV4 protocol using URI. Uniform Resource Indicator mapping techniques are involved to preceding the particular type of HTTP-CoAP cross proxy.

3.1.2 Transport and Application Layer

Most of the cases traffics are accomplished in application layer due to HTTP over TCP, which is the unconstrained protocol stacks. HTTP protocol is customized into human readable, less scalable and poor performance. To overcome this issues using CoAP protocol over UDP. The main advantage in CoAP provides retransmission of data, which gives reliability of data in constrained devices and also CoAP can associate with the HTTP because its supports the REST methods of HTTP (GET, PUT, POST, DELETE).

3.1.3 Data Format

In traditional unconstrained devices offers Extensible Markup Languages (XML), nevertheless the size of XML messages is too long and it's not suitable into IoT nodes. Hence compressing the XML messages of large size of data into compact one called as EXI. These compressing techniques are introduced in International standards of W3C.

4 EXPRIEMENTAL RESULTS

In this, section experimental results show that evaluation of automatic accident notification is identified based on GPS, Accelerometer Sensor.

The system performs the accident notification through the LCD display, which provides the overall system. It will used to define the system to ensure the automatic accident notification. [Fig.3]

To obtained the fast and accurate location of vehicle, we using the GPS. It used to find the accurate location of the vehicle and it's sent the location details to the CCU. In most of the accident, we can`t find the accurate position of the vehicle, where the accident occurred. To find the location of the GPS uses the GOE-technology to get the longitude and the latitude of the coordinates, where the accident occurred. Whenever the accident occur the position of the Direction, whether it may be the north, south, east and west. It may calculate the angle which is uploaded in the Google satellite. [Fig.4], also its used to identify the speed of the vehicle by using the potentiometer, which had been attached in the OBU vehicle. It provides the information to the CCU by the ZigBee and it receives the message from the accident zone, whether the accident is minor, moderate and severe. This helps us to intimate the emergency services according to the severity.

In this system the main modules is to estimate the accident and helps us to provide the rescue services. Using the Novel Intelligent System we can identify or detect the road accident by automatically. For calculating the accident severity we can use the accelerometer sensor to find out the speed. It derivate the speed and the position of the vehicles and calculate according to the accelerometer shaking. It will send the message to the control unit according to the speed of the vehicle and also convey the position of the vehicle to the server. [Fig.5]

The following cloud control unit is used to store the data by updating by fraction of a second to it. They contain the Location of the accident and the speed of the vehicle and the severity of the accident.

The main object of the IoT in the Accident Detection is to manage the real world control among the road accidents. It may use to proceeding the helpline for the public by using this detection and stored in cloud control unit and helps to many social networks. [Fig.6]

The photocopy of screenshots of the overall system shows below.

Fig3.Notification System

Fig4.Latitude and Longitude of the Vehicle

Fig5.Position and Speed of the Vehicle

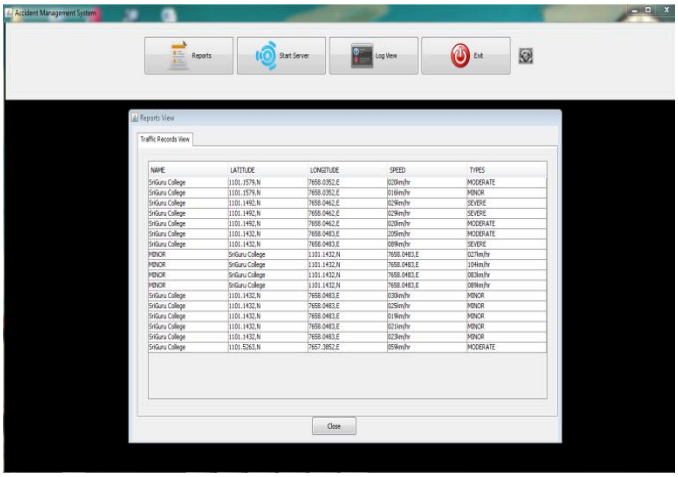

Fig6.Cloud Control Unit

5 CONCLUSION

In this paper, automatic notification of accidents to M2M Client and M2M server using transport protocol of ZigBee IEEE 802.15.4 standard wireless stack is placed on the top of the application. However 6LoWPAN wireless protocol stacks that is sits on the microcontroller in the LoWPAN wireless nodes of vehicle and its gives the lower power consumption and reduced data bandwidth, which results the data can be easily forwarding into cloud resources and other M2M client vehicle. Our system can increasing speed of dataflow and improves overall rescues resources to injured peoples as soon as possible.

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