A Novel Approach for Ultrasonic Sensor Obstacle Detection Using Internet of Things

Daggubati Vinay Sai, Ch.KiranBabu, K. Sai akhil, Naresh Vurukonda, Ashok K. Patel

Abstract: ***With the advance of technology in term of speed and modularity, the automation of land transport system comes into reality. The industrial internet of thing (IIoT) has on its peak by providing more accurate, cheap and small sensor, cheap and efficient processor to process sensed data in the and long range of unlicensed wireless communication. In the same speed automobile sector has also launched unmanned car, truck, buses which are free from humane error (drunk and drive, angriness, sleepiness). In this direction obstacle detection and avoidance is an essential module of any automated transportation system. The optical, infrared and sonar sensor are widely used for the obstacle detection in the transportation system but they have their own limitation and therefore incorporate multisensory technique to achieve higher accuracy. In the present study ultrasonic sensor has used for the obstacle detection, bluetooth has used for data transmission and arduino board has used for the processing to avoidance algorithm for the obstacle***

Keywords: Obstacle detection, bluetooth, ultrasonic sensor, driverless transport.

I. INTRODUCTION

A. INTERNET OF THINGS

The Internet of Things (IOT) is the network of physical devices, sensors, abode household applications, software, collecting data and exchange data. IoT includes stretching out Internet network to every physical gadget and regular items that are generally idiotic or does not utilize the Internet past standard gadgets, for example, work areas, workstations and cell phones and tablets [1]. With inherent innovation, these gadgets can discuss, collaborate, and remotely screen and command over the Internet.

Emergency notification for remote health monitoring system can be enabled by using IOT devices [2]. Those health monitoring systems could be ranging from heart rate & blood pressure monitors to a system capable of advanced monitoring systems such as specialized implants ranging from peacemakers to fit bit electronic or hearing aids. A couple of hospitals have already started using beds that can identify if they are occupied or not and if the patient is trying to stand up from the bed or not, most beds can adjust itself. To make sure appropriate support & pressure is given to the patient without any interaction of the nurses. it has been said in a report which was published in 2015 by Goldman scars that health care IOT devices that can save $300 billion in united states annual health care costs by improving the Revenue an decreasing the expenditure[3]. Anyway the usage of mobile devices that had support for medical, which have led to the implementation of the m-health, that is used to capture, analyse, store and transmit health statistics from various fields, including biomedical acquisition and sensors.

There are various IOT technologies in farming which includes collecting of real time data on current environment that include pest infestation, humidity, temperature, rainfall etc. Then data that is being collected can be used to automate the farming techniques and can be informed on decision to improvise quantity and quality to reduce risk and waste, and minimize the actions needed to maintain the crops. For example, farmers now can monitor soil moisture and temperature of farm from remote area and even apply the actions required for precision farming.

A. HISTORY OF IOT

The evolution of definition of IOT due to convergence in machine learning, various technologies, control systems, commodity sensors, real time analytic, embedded systems in traditional fields, home & automation, wireless sensors and others that have contributed in evolution of Internet of Things.

The concept of using a smart device through a network was circulated or discussed in the early 1982, where the first internet connected device was introduced at the Carnegie Mellon University. This is a modified coke machine, the purpose of the machine was to report the inventory and check the temperature of the drinks. In 1994, Reza Raji portrayed the idea in the IEEE range as "little". Somewhere in the range of 1993 and 1997, a few organizations proposed arrangements [4], for example, Microsoft at Work or Novell s NEST. The field picked up force when Billi Joy imagined a gadget to the correspondence of as a part of their "Six Networks" framework, appeared at the World Financial Gathering in Davos in 1999. The articulation "internet of Things" was presumably sired by Kevin Ashton of Procter and Bet, later MIT in 1999, in spite of the fact that he inclined towards the articulation "internet for things". Around that minute, he thought of that unmistakable reiteration of the radio. It is Basic for the Internet of Things, which would enable PCs to deal with every single individual thing [5].

By describing the internet of Things as "basically the moment that most" things or components "were related with the Web that people,"

Revised Manuscript Received on April 07, 2019.

Daggubati vinay sai, Computer Sciences, Koneru Lakshmaiah Educational Foundation , Vaddeswaram, India.

Ch.Kiran babu, Computer Sciences, Koneru Lakshmaiah Educational Foundation , Vaddeswaram, India.

K.sai Akhil, Computer Sciences, Koneru Lakshmaiah Educational Foundation , Vaddeswaram, India

Naresh vurukonda, Computer Sciences, Koneru Lakshmaiah Educational Foundation , Vaddeswaram, India

Ashok k.patel , Computer Sciences, Koneru Lakshmaiah Educational Foundation , Vaddeswaram, India

Cisco systems surveyed that IoT was conceived somewhere in the range of 2008 and 2009, with a connection between things/individuals that it developed from 0.08 "2003 to 1.84 in 2010.

1.3 Motivation

• Currently the main sources of deaths caused by the vehicles are occupied drivers, alcoholic drivers and drivers who over speed.

• Individuals with vision issues and other physical constraints that keep them from driving may in the end move

II. LITERATURE REVIEW

NS Rajput et al, autonomous vehicles will be having a significant role in smart cities for deploying intelligent transportation system for public [14]. These autonomous systems are powered electrically which are low cost and environment friendly, these systems are equipped with ultrasonic and in view of camera Frameworks of low computational multifaceted nature that are roused by human driving abilities. Individuals take past visual encounters and make deductions to appraise the ideal driving way. In this work we have executed a straightforward framework to maintain a strategic distance from impediments for the sending of self-sufficient vehicles. Framework that utilizes a profound neural system and copying the human methodology of basic leadership to achieving efficiency in autonomous driving. Such intelligent systems are more efficient.

Piyush Patil et al, have proposed a system which will monitor pollution and Noise created by vehicle [15]. The configuration of System and Experiment result are discussed in length. Testing of the prototype has done successfully. Our proposed system is a low cost, simple to operate and portable. The developed system provides better efficiency and accuracy with low cost than the existing proposed system. It will gradually reduce Global Warming if implemented on a global scale.

Ling Hu et al, Member filter which is unified to detect either the vehicle license plates or the vehicles from the digital camera imaging sensors of urban surveillance systems in smart cities [16]. To the best of our knowledge, we are the first to design this kind of filter to detect the vehicle/license plate objects. We tested our filter with different images. The results show that our filter can automatically detect the highest energy frequency areas out from the images, which makes our proposed algorithm a simple and effective method to automatically detect vehicle objects for IoT.

Suzanne Choney et al, Bluetooth does not mean a headset that looks unusual when a phone client strolls the city roads. This innovation is assuming an expanding job in the car advertise where Bluetooth for sans hands considers builds the quantity of processing plant introduced vehicles, plays out similar assignments, and transmits computerized music records to the vehicle's sound system. In the up and coming year, Bluetooth gushing video can be conveyed to the rearward sitting arrangement excitement gadget, and maybe the vehicle's Bluetooth sensor can advise the driver when the tire weight is excessively low. "This innovation, second broadly utilized beside a vehicle's Bluetooth headset, would now be able to stream music through a vehicle stereo utilizing a cell phone or MP3 player. Bluetooth, "said Michael Foley, official executive of the Bluetooth Special Interest Group that built up the innovation. Behind the trend is the growing number of laws requiring drivers to keep their hands on the wheel and not on a dial pad. In the United States, several states now require hands-free calling devices for drivers who want to talk on the phone. California and Washington hands-free laws took effect July 1. New York, New Jersey, Connecticut and Washington, D.C. also have such restrictions. Japan, Britain and France are among other countries that have similar laws. Janku et al. has given a use case of obstacles detection in the surface using combining of ultrasonic sensor with the infrared sensor. Their approach basically for avoiding the big obstacle which will create more damage [7]. Their implementation is not fully automated required humane intervention using remote control. Gal O et al. has developed an automatic method to acquire images using video sensor, identify the obstacles, and track target location of obstacles from an Unmanned Surface Vehicle (USV)[11]. Their work of recognizing the obstacle and decision making based on the obstacle recognition, make a difference in the unmanned transport system development.

Debattisti S et al. has done a survey on the different sensor available for the obstacle detection[10]. Then a study was made for various algorithm used for estimation the distance in the obstacle detection. Finally they developed optical detection system by combining vision sensor with obstacle detecting sensor. Kohara et al. have used stereo vision sensor for developing occupancy grid map, which is utilised for the modelling the position of obstacles [9]. A virtual disparity image (VDI) is used in the modelling of obstacle detection algorithm. In general it is used for identification of road surface but they used for the obstacle map generation. Similar to Janku Ramachandran et al have developed obstacle detection for visually impaired people [8]. They have used a fusion of IR and ultrasonic sensor for signal transmission and TSOP receiver for receiving the reflected signal from the obstacles. Kim and Kim et al. have used ultrasonic sensor ring for obstacle detection. They have reduced the effect of overlapping beam pattern[6]. They have used geometric method for estimating the obstacle position. They have developed model by considering the positional uncertainty and computation cost.

III. MATERIALS

The system development required an Arduino UNO for processing the sensor (Echo ultrasonic sensor) data and signaling the actuator (DC motors) to actuate. The Bluetooth module is required for communication with the system and its components. The whole system is connected through the bread board. The details of these instruments are given below:

A. Arduino UNO:

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is outfitted with sets of advanced and simple information/yield sticks that might be interfaced to

different extension sheets and different circuits. Smaller scale chip is 8 bit is as shown in Fig. 1

Fig. 1: Arduino Uno board

B. Bluetooth Module

Remote Serial Communication, HC-05 Bluetooth Module is most requesting and famous because of its low cost and very high highlights. This module can be utilized in Master or Slave Mode and simple switchable between these two modes, by default Slave mode is designed. Bluetooth module Shown in Fig. 2, modes can be changed utilizing AT Commands. The slave mode in HC-05 can't start an association with another Bluetooth gadget, however can acknowledge associations. Ace mode can start an association with different gadgets, bluetooth specifications shown in table1.

Fig. 2: HC-05 Bluetooth Module

Parameter	Values
Bluetooth protocol	v2.0+EDR
Frequency	2.4GHz ISM band
Modulation	GFSK(Gaussian Frequency Shift Keying)
Emission power	≤4dBm, Class 2
Sensitivity	≤-84dBm at 0.1% BER

Table 1: Bluetooth specifications

C. Echo Sensors

Echo Light Sensors. The Echo Light Sensor (also known as a PhotoSensor) provides light level measurement and lighting control for the connected Echo control system. The sensor measures lighting conditions to maintain a programmed lighting output in both dimmed and switched systems. shown in Fig. 3 ultra sonic sensors.

The HC-SR04 ultrasonic sensor uses sonar to measure distance to an object. It offers excellent range accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material like Sharp rangefinders are (soft materials like cloth can be difficult to detect). Module main technical parameters: shown in table 2 and pin configuration shown in

Parameter	Values
Working Voltage	5V(DC)
Static current	Less than 2mA
Output signal	Electric frequency signal, high level 5V, low level 0V.
Sensor angle	Not more than 15 degrees
Detection distance	2cm-450cm
High precision	Up to 0.3cm
Input trigger signal	10us TTL impulse

Table 2: Echo Sensor specifications

D. Ultrasonic Sensor Pin Configuration

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V

2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system

Table 3 : Ultrasonic Sensor Pin Configuration

Fig. 3: HC-SR04 ultrasonic sensor

E. DC MOTORS

The DC motor is a machine that transforms electrical energy into mechanical energy in form of rotation. Its movement is produced by the physical behavior of electromagnetism. DC motors have inductors inside, which produce the magnetic field used to generate movement.

In a typical DC motor, there are permanent magnets on the outside and a spinning armature on the inside. When you run electricity into this electromagnet, it creates a magnetic field in the armature that attracts and repels the magnets in the stator. So the armature spins through 180 degrees. Shown in Fig. 4

Fig. 4: Dc motor

F. Bread Board

A breadboard is a construction base for prototyping of electronics. Originally it was literally a breadboard, a polished piece of wood used for slicing bread shown in Fig. 5

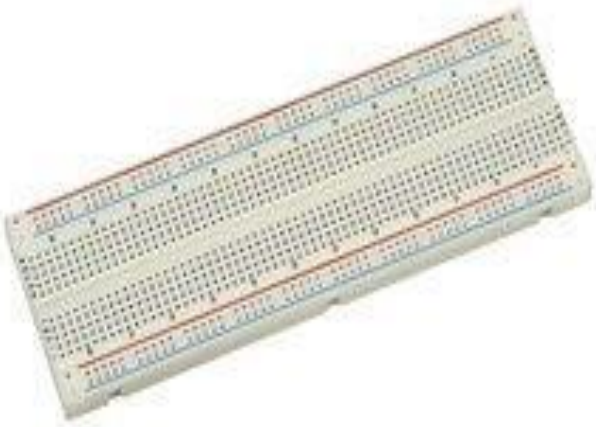

Fig. 5: Bread board for connection of components

Safety - taking the current scenario in to the situation we humans are bad at driving. every year there are 1.24 million deaths on road worldwide which acts as a proof how bad we are. Unlike humans, autonomous vehicles will never do a reckless driving nor over speed and obey the traffic rules for antibusing this autonomous technology we can multi task while driving such as texting a friend or collegues.in a single sentence we can say that there is a lot of safety provided by automation when compared to human

.Congestion – well compared to anything in this world we have more humans resulting in more number of vehicles and such huge number of vehicle count is leading to traffic jams between your current location and your destination. with the help of driverless vehicle we can travel in a structured convey, meters apart without needing any use of brakes to filter your way through traffic and having a smooth ride

Parking - parking shall not be a problem anymore the autonomous vehicle can handle it self. at the point of arriving at our destination we shall get out of the car at the front door and leave the car to follow a synchronised path to park itself which will be lead to avoid parking tickets and dents while parking. Later we can summon the vehicle by using our smart phone to our location resulting in free up of the road space [18].

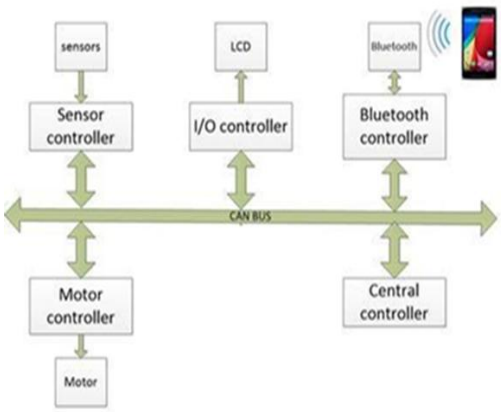

Fig. 6: working of self-braking RC car

microprocessor (Arduino) and Bluetooth module to send remote instructions to the vehicle. System Design: The framework comprises of three subsystems: input unit (ultrasonic sensor), handling unit (PC) and RC vehicle control unit.

Input unit: - An Arduino board (UNO), an appended ultrasonic sensor HC-SR04, is utilized to gather input information. Two customer programs keep running on Arduino to transmit information from ultrasonic sensors to the PC through a neighborhood association.

Processing unit: - The preparing unit (PC) handles various assignments: accepting information from Arduino, preparing and expectation of the neural system (address), object recognition (stop flag and semaphore), monocular vision of separation estimation, and sending guidelines to Arduino through a USB association.

Control unit: The RC vehicle utilized in this errand has an on/off switch type controller. In this manner, an Arduino board is utilized to imitate exercises of fixing catches. Four Arduino pins are chosen to interconnect four chip contributes the controller, identified with the forward, in reverse, left and right exercises independently. The Arduino pins that send the LOW banner demonstrate the earth relationship of the pins of the controller chip; of course sending HIGH flag. The Arduino is related with the PC through USB. The PC sends the guidelines to Arduino utilizing the successive interface, and from that point onward, Arduino cautiously peruses the directions and forms the LOW or HIGH banners, repeating exercises to drive the RC vehicle.

IV. OBJECTIVE AND GOALS

• The fundamental objective of self driving vehicle is to maintain a strategic distance from mishaps.
• Expanding roadway limit by lessening the separations between vehicles
• Individuals are allowed to focus on different undertakings or to rest amid their voyages.

V. PROPOSED SYSTEM

Our main focus was on avoiding obstacles while driving or while in traffic. It even avoids the vehicles while in driving in highway in order to stop the accident .initially the distance between the obstacle and the vehicle is taken through ultrasonic sensor and passed through the Arduino board to process the data and actual real time results are sent to near corresponding Bluetooth enabled devices. The connection between sensor, actuator and processing units are displayed in Fig. 7.

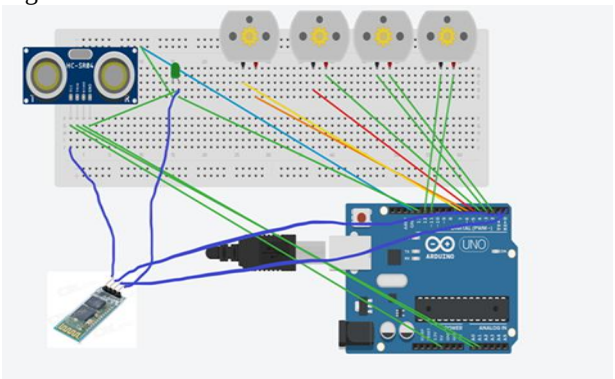

Fig. 7: Connection of sensor, actuator, and processing board for model development

Using the following data we can send this through a neural network and train the network to achieve greater efficiency for autonyms vehicle.

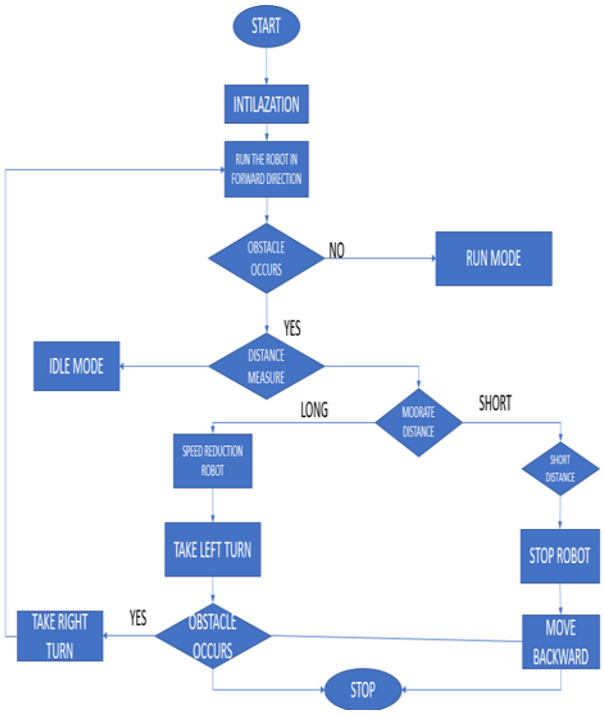

Fig. 8: Flow chart of proposed methodology

A. Advantages of Proposed System:

• Overseeing traffic stream to build street that focuses on limit free traffic.
• Remembering vehicle operators from driving enabling them to focus on other undertaking amid their adventure.
• To stay away from mishaps.
• Increment the street route limit by lessening the separations between vehicles.

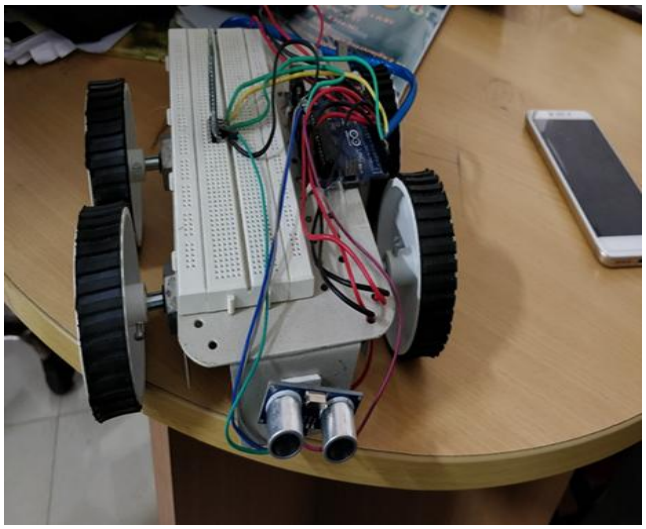

Fig. 9: Top view of designed model for obstacle detection

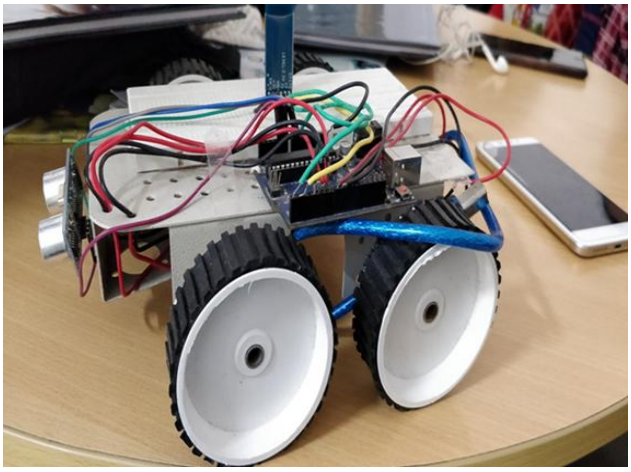

Fig. 10: Side view of designed model for obstacle detection

VI. FUTURE WORK

Later on we may almost certainly message, chat on the telephone, have breakfast, read messages and surf the majority of our cherished internet based life locales, all while in transit to work. To acquire exact and precise outcomes LASER sensors are required. These sorts of sensors are basically costly. In future works, if the laser sensors named "LIDAR" is utilized; most likely the outcomes will have less mistakes**.**

VII. CONCLUSION

In the study a laboratory scale system has developed and tested for obstacle. The system performing accurately desired action whenever an obstacle was detected in the range of action. The driver less vehicle's advances improves vehicle's dependability serves to loss of control. Driver less vehicles are intended to limit mishaps by tending to the primary driver of impacts: driving mistake, diversion and sleepiness.

REFERENCES

1. McEwen, A., & Cassimally, H. (2013). Designing the internet of things. John Wiley & Sons.
2. Hassanalieragh, M., Page, A., Soyata, T., Sharma, G., Aktas, M., Mateos, G., ... & Andreescu, S. (2015, June). Health monitoring and management using Internet-of-Things (IoT) sensing with cloud-based processing: Opportunities and challenges. In 2015 IEEE International Conference on Services Computing (pp. 285-292). IEEE.
3. Goldman, M. P., & Weiss, R. A. (2016). Sclerotherapy E-Book: Treatment of Varicose and Telangiectatic Leg Veins. Elsevier Health Sciences.
4. Raji, R. S. (1994). Smart networks for control. IEEE spectrum, 31(6), 49-55.
5. Ashton, K. (2009). That 'internet of things' thing. RFID journal, 22(7), 97-114.
6. Kim, S., & Kim, H. B. (2010, August). High resolution mobile robot obstacle detection using low directivity ultrasonic sensor ring. In International Conference on Intelligent Computing (pp. 426-433). Springer, Berlin, Heidelberg.
7. Janku, P., Dosek, R., & Jasek, R. (2014). Obstacle detection for robotic systems using combination of ultrasonic sonars and infrared sensors. In Modern Trends and Techniques in Computer Science (pp. 321-330). Springer, Cham.
8. Ramachandran, S., Nair, P. R., & Vasudevan, S. K. (2018). Cane Free Obstacle Detection Using Sensors and Navigational Guidance Using Augmented Reality for Visually Challenged People. In Computational Vision and Bio Inspired Computing (pp. 324-334). Springer, Cham.
9. Kohara, K., Suganuma, N., Negishi, T., & Nanri, T. (2010). Obstacle detection based on occupancy grid maps using stereovision system. International Journal of Intelligent Transportation Systems Research, 8(2), 85-95.
10. Debattisti, S. (2012). Perception Tasks: Obstacle Detection. Handbook of Intelligent Vehicles, 1033-1041.
11. Gal, O. (2011). Automatic obstacle detection for USV's navigation using vision sensors. In Robotic sailing (pp. 127-140). Springer, Berlin, Heidelberg.
12. Janku, P., Dosek, R., & Jasek, R. (2014). Obstacle detection for robotic systems using combination of ultrasonic sonars and infrared sensors. In Modern Trends and Techniques in Computer Science (pp. 321-330). Springer, Cham.
13. Kohara, K., Suganuma, N., Negishi, T., & Nanri, T. (2010). Obstacle detection based on occupancy grid maps using stereovision system. International Journal of Intelligent Transportation Systems Research, 8(2), 85-95.
14. Rajput, N. S., Mishra, A., Sisodia, A., & Makarov, I. (2018, February). A novel autonomous taxi model for smart cities. In 2018 IEEE 4th World Forum on Internet of Things (WF-IoT)(pp. 625-628). IEEE.
15. Patil, P. (2017, May). Smart IoT based system for vehicle noise and pollution monitoring. In 2017 International Conference on Trends in Electronics and Informatics (ICEI)(pp. 322-326). IEEE.
16. Hu, L., & Ni, Q. (2018). IoT-driven automated object detection algorithm for urban surveillance systems in smart cities. IEEE Internet of Things Journal, 5(2), 747-754.
17. Ahmed, R., & Dharaskar, R. V. (2012, March). Study of mobile botnets: An analysis from the perspective of efficient generalized forensics framework for mobile devices. In IJCA Proceedings on National Conference on Innovative Paradigms in Engineering and Technology (NCIPET 2012) ncipet (15)(pp. 5-8).
18. Vurukonda, N., Rao, B. T., & Rao, N. S. Analysis on RFID-GSM Enabled Intelligent Transfer System.

AUTHORS PROFILE

Daggubati vinay sai, Is a B.tech student in Professor in Department of CSE at Koneru Lakshmaiah Education Foundation, Guntur

Ch.Kiran babu, Is a B.tech student in Professor in Department of CSE at Koneru Lakshmaiah Education Foundation, Guntur

K.Sai Akhil, Is a B.tech student in Professor in Department of CSE at Koneru Lakshmaiah Education Foundation, Guntur

NARESH VURUKONDA, is a PhD candidate in the area of Cloud Security at the KL(Deemed to be University),A.P. and Also working as an Assistant Professor in the Dept of CSE at KL(Deemed to be University). He had a Bachelor Degree, in Computer Science & Engineering, JNTUH. Being alumni of JITS. After that he received his Masters Degree in JNTUH. And in the year of 2013 &14 and 2016&17 he received Best Teacher award and for his excellence in educating and coaching for undergraduates.

Dr. Ashok Kumar Patel, is an Assistant Professor in Department of CSE at Koneru Lakshmaiah Education Foundation, Guntur, AP. He has awarded his PhD in 2018, MTech in 2012 and BE in 2007. He has published many paper in peer reviewed journals. He attended many national and international conference. His research interest is machine learning, pattern recognition, image processing, internet of things.