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Design and Implementation of Multimedia Evidence Collection System Using Image Processing with IoT

Nagaraj B Kalligudd, B. M. Reshmi

***Abstract:** Every day for many reasons, a lot of life's lost in accidents. To solve the causes of the accident, essentially it monitors how, when and where a vehicle is being driven, and records the data such as location and image soon after the accident, which is later used for forensics. An Automatic Accident Detection (AAD) algorithm will be developed to achieve that task; suitable thresholds are defined to determine the occurrence of accidents. The work in this paper is on implementation using concepts of IoT with embedded systems Raspberry Pi and image processing techniques.*

***Keyword:** Automatic Accident Detection, IoT, vehicle driven*

I. INTRODUCTION

According to the World Wellbeing Organization, more than a million individuals in the world pass away each year because of transportation-related mishaps. In arrange to respond to this circumstance, the dark box framework draws the to begin with step to unravel this issue that crosses national boundaries and undermines the security and well-being of individuals worldwide. Presented to a portion of the Joined Together States showcase in 1999, the dark box framework demonstrated to be proficient. In any case in the last-mentioned case, the framework was implanted in the vehicle. Subsequently, in expansion to progressing the treatment of crash casualties and the street status in arrange to diminish the passing rate, developing more secure vehicles, and making a difference in protection companies with their vehicle mischances examinations, the fundamental reason for this paper is to create a dark box framework that can be introduced to any vehicle all over the world [1][2] [19] [20] [21] [22]. The add-up to vehicle populace in the world is expanding radically, and India is moreover nowhere behind in this populace tally. Agreeing to U.S. distributor Wards, as of 2010 there were 1.015 billion engine vehicles in utilize in the world. This figure speaks to the number of cars, light, medium and overwhelming obligation trucks, and buses, but does not incorporate off-road vehicles or overwhelming development gear.

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*Correspondence Author(s)

Nagaraj B Kalligudd*, Department of CSE, Atria Institute of Technology, Bengaluru -560024, India. E-mail: nagarajbgk@gmail.com

Dr. B. M. Reshmi, Department of AIML, Basaveshwar Engineering College, Bagalkote-587103, India. E-mail: chetanasrinivas@ewit.edu

The world vehicle populace passed the 500 million-unit stamp in 1986, from 250 million engine vehicles in 1970. Between 1970 and 1980, the vehicle populace multiplied generally each 10 a long time. No wonder the nation which is called a subcontinent has such colossal numbers and development rates in vehicle tallies. But the same development ought to be dealt with carefully else the control of street mishaps will be a huge errand. The recurrence of activity collisions in India is among the most noteworthy in the world. Engine vehicle infiltration is moo by worldwide guidelines, with as it were 103 million cars on the nation's streets. In expansion, as it were around 10% of Indian families possess a cruiser. Despite this, the number of passings caused by activity is among the most elevated in the world and is still expanding. The car industry in India is Expanding. The car industry in India is right now quickly developing with a yearly generation of over 4.6 million vehicles, and vehicle volume is anticipated to rise enormously in the future.

II. CLASSIFICATION OF ROAD TRAFFIC ACCIDENT

A street activity mishap can be classified into taking after sorts: People on foot, pedal cyclists, motorcyclists, drivers of cars,com-metrical and traveller vehicles, creature vehicle collision, mass casualty occurrence, and Acts of God [3],[4].

A. Pedestrians

Hitting a person on foot whereas driving a car is exceptionally common. A think about highlighted that the Islamabad Police division detailed 53.3% of fatalities for person on foot cases are 56% of detailed deadly activity mishaps [5].

B. Pedacyclists

Due to the moderate development of pedal cyclists, they are not seen by vehicles which over another car and all of a sudden hit the pedal cyclists. As the engine cycle moves much quicker than the cycle engine cyclists are less powerless than pedal cyclists [6].

C. Motorcyclists

Riding a motorbike is a great and popular action in most parts of the world due to fewer pace prerequisites, tall mileage and less contamination. If a vehicle hits a motorcyclist, due to the need for security highlights on a bicycle, the rider will limitedly get harmed extremely in most cases. The chance of survival of a motorcyclist is less compared to a harmed individual in case a vehicle hits a car [7].

D. Drivers of Cars, Commercial and Passenger Vehicles

In this paper, the author has discussed that Most of the time, it is noticed that an accident occurs when a person is a few milesaway from his home [8]. The basic reasons for car accidents are over-speeding, casual behaviour, and reckless and unsafe driving. Table II shows common types of car accidents [9].

E. Animal Vehicle Collision

In this paper creator has talked about approximately the collision between a creature and a vehicle. Insights show that the mortality of creatures is expanding in North-East China due to mischances as compared to chasing [10]. Insights appear that 67% of drivers in Northern Tanzania felt that creature vehicle mischances were due to overspeeding and night-time moo permeability [11] [23]

F. Mass Casualty Incident

It is an occurrence in which there are more casualties than typical mischance has [12]. These mishaps incorporate Numerous vehicle collisions, building collapses, mass travel mischances, HAZMAT (Perilous Materials) occurrences, WMD (weapon of mass pulverization), multiple shooting casualties, and chemical exposure.

G. Act of God

It is a mischance that happens completely from common causes with no human inclusion [13]. These mischances incorporate tornadoes, sudden passings, seismic tremors, surges and rough winds.

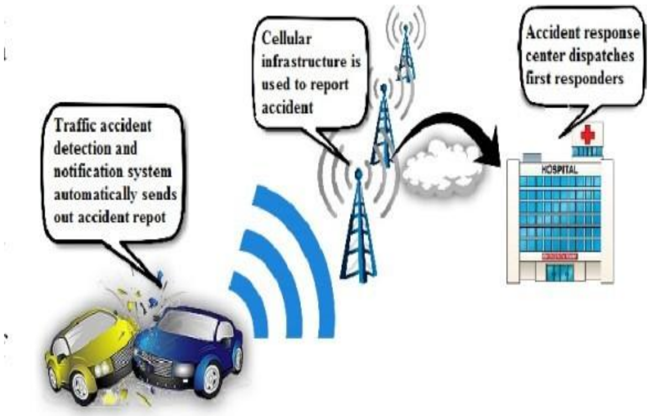

Figure 1. Traditional Accident Detection System Using a Smartphone

III.LITERATURE SURVEY ON AUTOMATIC ROAD ACCIDENT DETECTION

The researchers have proposed different methods to detect an accident automatically. These techniques include road accident detection using smartphones, GSM and GPS technologies, VANET, and mobile applications.

A) Using Smartphones

In [14], the automatic detection of accidents using smartphones is described. Car manufacturers like BMW or GM have incorporated a built-in automatic collision notification system, See Figure. 1. They use sensors like accelerometers and airbag deployment monitors in their vehicles to determine an accident event and send this information using built-in cellular radios to the response centre. Unfortunately, most cars do not have a programmed collision notice framework. So in place of this system, the smartphoneis used which not only detects the accidents but after detecting them, sends this information to the concerned departmenton its own as well. Using smartphones in place of automatic collision notification systems has many advantages we can carry them easily and it can provide an accident detection notification system in every type of vehicle like a bicycle ora motorbike. Furthermore, as every smartphone isassociated with its owner it is easy to identify the victim. The sensors in a smartphone identify the GPS location, speed and acoustic signature of the vehicle during an accident and send this information with the help of a built-in cellular connection to the central server which further sends thisinformation to the emergency department, See Figure. 2.

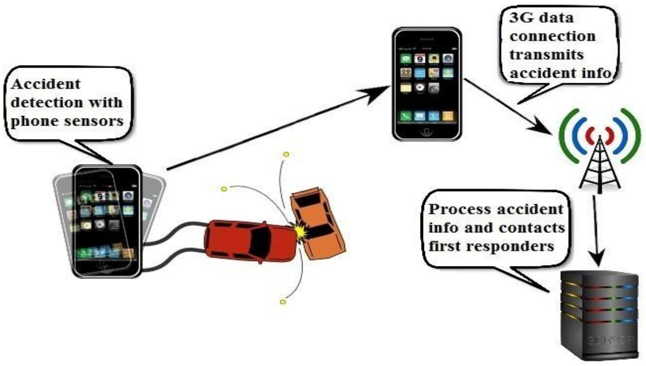

Figure 2. Accident Detection Scheme through GSM and GPS

B) Using GSM and GPS

In [15], the automatic detection of an accident and messaging system is demonstrated by using GSM and GPS technologies. The GPS satellites are used to identify the exact location of the incident, speed, time and direction.

In a typical microcontroller-based road accident detection and communication system, an infrared sensor is used to detectobjects. In case of an accident, the system determines the longitude and latitude of a position where an accident occurs through the GPS module. Then it sends a message which contains the position of the vehicle to the emergency department. Figure 3 shows the procedure of accident detection through GSM and GPS technologies.

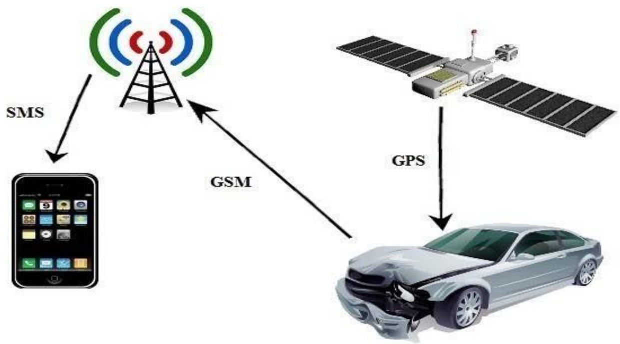

Figure 3. Accident Detection Scheme Through GSM and GPS

C) Using Vehicular Ad-hoc Network (VANET)

In [16], VANET is utilized as an accident detection techniquewith the help of two sensors, a crash sensor and an airbag system.

When these sensors sense any accident, the information is sent to a microcontroller-based system. The location of the accident is determined using GPS and the system sends the location of the accident to a predefined number using GSM. The transmission of messages to the rescue team is sent through VANET, the ad-hoc network between moving vehicles. The VANET is used to transmit the message to the rescue team. The transmission of an alert message starts withbroadcasting the message from a source node to all the vehicles on the road. The VANET structure consists of a set of On-Board Units (OBU), that are fixed inside the vehicle and a Road Side Unit (RSU), which is fixed along the road. The OBU and RSU interact with each other using dedicated short-range communication (DSRC) [17]. The communication can be vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), or infrastructure-to-infrastructure (I2I) See Figure 4.

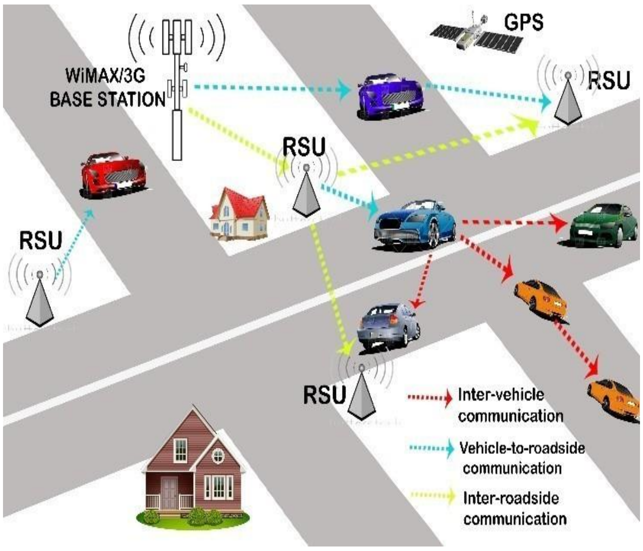

Figure 4. The Architecture of VANET

D) Mobile Application

In [18], mischance discovery through a portable application is displayed. The activity is taken by the European Commission (EC), who announced that eCALL is required in each car. The eCALL is a versatile application that recognizes the mishap naturally. When a mishap happens it sends an ask for offer assistance to the crisis therapeutic administrations by dialling a crisis number. The call is started by the cellular arrange to the closest crisis centre.

The graphical client interface (GUI) of the application comprises a huge square in which one colour ruddy, green, or yellow is shown. The colour demonstrates the condition of the street at a specific moment. *Avertino:* This application cautions the client with the offer of assistance of a visual and capable of-being-heard alarm. These alarms can be on the premises or they can be temporary.

a) *I On Street Augmented Driving:* This application cautions the client when he does not keep the least security removed between the cars. The GUI interface of the application is appeared in Figure. 5

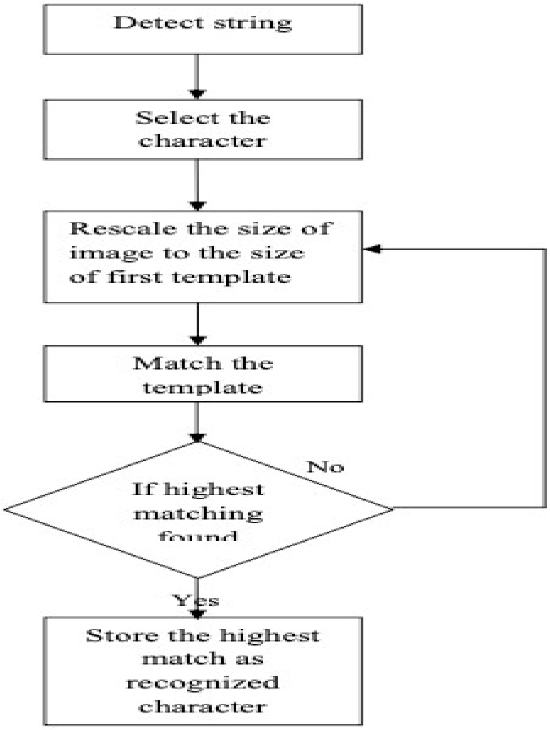

Figure 5. The GUI Interface of the Application

IV. METHOD AND PROPOSED SYSTEM

The problem addressed in this research is a preliminary approach to the implementation of an automatic accident detection algorithm on traffic highways. Image sequences are extracted from the video camera, mounted on the pole at the highway. The image sequences are fed to the accident detection module system where the occurrence of the accident is determined. The automatic accident detection algorithm consists of vehicle detection, vehicle tracking, vehicle parameter extraction and accident detection sections. After analyzing the image sequence, the system identifies the moving vehicles in the image and tracks them using low-level features. Soon after an accident accelerometer sensor will trigger to take photos and apply image processing techniques to get the number plate and send it to the cloud and using a GPS modulelocate the place where the accident occurred.

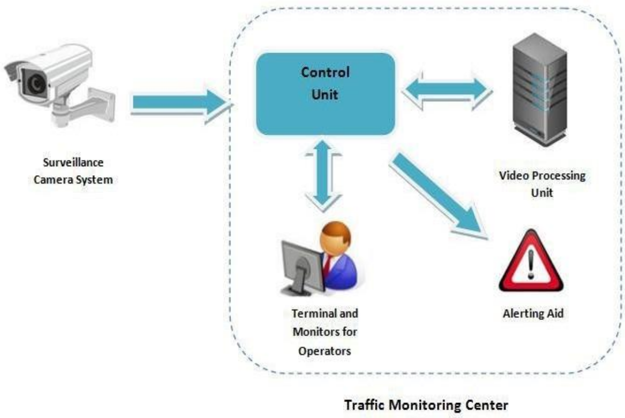

Figure 5. Traffic Monitoring Center

A. Surveillance Camera System

The Camera System contains a group of cameras to monitor specific areas and also record videos from them. Cameras used can be analogue or digital. However, analogue cameras suffer from low resolution, storage limitations and difficulty in searching through captured images. So digital cameras aremore preferred.

B. The Control Unit

It receives videos from the Surveillance cameras and forwards them to the processing unit and the monitors. It also receives the accident notification from the video processing unit issues a notification to the notification unit and automatically displays the accident images to the operators.

C. Alert Aid

The alert aid displays the alarm signal from the control unit.

D. Terminal for Operators

The Terminal provides a platform for traffic operators to interact with the system. The surveillance videos can be viewed in real time or recorded for later review. On-site operators can review and confirm accidents directly on monitors.

E. Video Processing Unit

The processing unit detects a sudden accident by processing video frames via an automatic Accident detection (AAD) algorithm, which will be discussed in detail in the following sections.

F. Automatic Accident Detection Algorithm

There are four major steps involved in the video-based crash detection algorithms, various research has been done on each section separately and good performance has been obtained. These are the following four steps.

1. Motion segmentation and vehicle detection.
2. Vehicle tracking.
3. Processing the results of tracking to compute trafficparameters.
4. Accident detection using the traffic parameters.

Once the vehicles are detected and tracked correctly in the frames, the next step in the process is to determine the occurrence of the accident using the extracted feature. using a flowchart, we can show this algorithm as in Figure 6

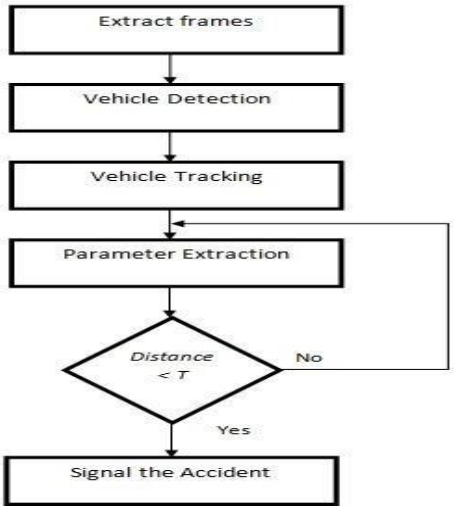

Figure 6 Flowchart of the Accident Detection Algorithm

G. Hardware and Software Support

a. Blynk Application on mobile phone:

The most popular IoT platform to connect your devices to the cloud, design apps to control them, and manage your deployed products at scale.

b. Raspberry Pi 3B+ with Camera Kit:

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad-core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market. The Raspberry Pi 3 Model B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3 Model B.

Figure 7. Raspberry Pi with Camera Kit

Use the Raspberry Pi 3 Model B and Raspberry Pi camera module to create a wireless, IP streaming camera, photo booth, time-lapse camera, and more. The wireless capabilities of the Raspberry Pi 3 Model B make it the most connected Raspberry Pi ever the connectivity of the Raspberry Pi and the camera module opens up a whole new world of possibilities Use the Raspberry Pi to wireless stream, as a security camera, for time-lapse photography, motion detection, and more! Includes the fastest Raspberry Pi to date Get connected right out of the box with built-in WiFi and Bluetooth Low Energy connectivity shown in figure 7 (Bluetooth must be enabled through commands) Enclosure is designed to give maximum use of the Raspberry Pi board while keeping it safe.

- Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
- 1GB LPDDR2 SDRAM 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE
- Extended 40-pin GPIO and USB 2.0 ports CSI camera port for connecting a Raspberry Pi camera.
- Micro SD port for loading your operating systemand storing data
- 5V/2.5A DC power input

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c. *Vibration Sensor to detect accidents:*

With signals from an accelerometer, a severe accident can be recognized. According to this project when a vehicle meets with an accident immediately Vibration sensor will detect the signal or if a car rolls over, and Micro electro-mechanical system (MEMS) sensor will detect the signal and send it to the ARM controller.

d. *U-blox NEO-6M GPS Module with EPROM:*

A battery is also included so that you can obtain a GPS lock faster shown in Figure 8. This is an updated GPS module that can be used with ArduPilot mega v2.

Figure 8. GPS Module with EPROM

This GPS module gives the best possible position information, allowing for better performance with your Ardupilot or other Multirotor control platform.

V. RESULTS AND DISCUSSION

The results that have been obtained from the above setup can be seen in the Blynk app as captured. Soon after sensors read accident trigger notifications as shown in Figure 9a. This shows the number place and confidence percentage of accuracy in formulating number plates and locates in the map using longitude, and latitude shown in figure 9b.

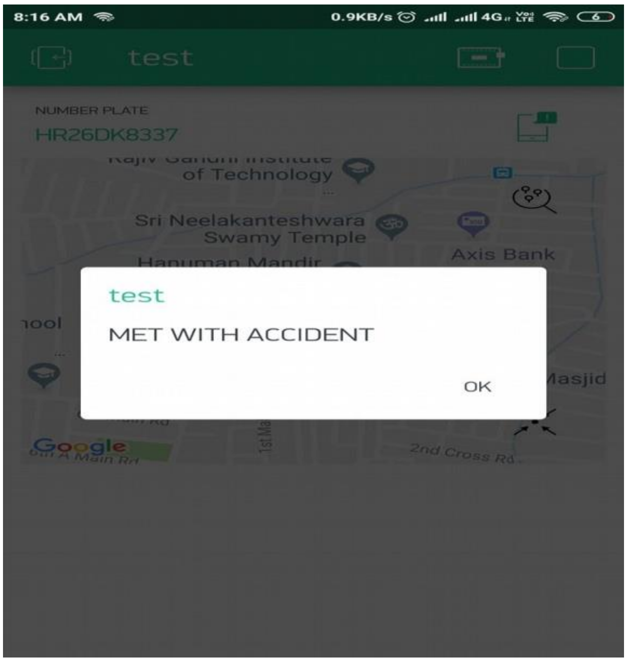

Figure 9a. Notification after An Accident

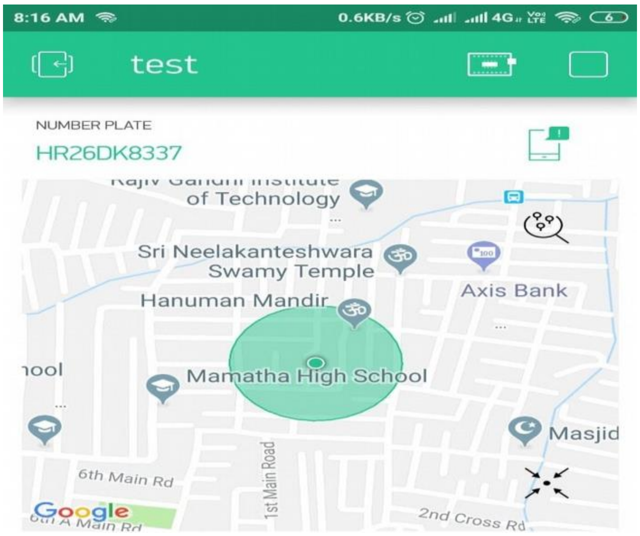

Figure 9b. Number Plate and Location Using GPS

VI. CONCLUSION

In this paper, we have checked and evaluated the accuracy of all related techniques. Using various algorithms developed a system which able to give a number plate of the vehicle after improving font type, noise in the image, tilting, etc. finally able to locate the place of the accident. In future the work can be done on these factors and to increase efficiency and accuracy further for better results.

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Ethical Approval and Consent to Participate	No, the article does not require ethical approval and consent to participate with evidence.
Availability of Data and Material	Not relevant.
Authors Contributions	All authors have equal participation in this article.

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AUTHORS PROFILE

Dr. B. M. Reshmi (PhD) is working as an associate professor in the Department of Artificial Intelligence and Machine Learning. Basaveshwar Engineering College, Bagalkote from last 28 Years. she received her PhD from Gulbarga university and published more than 32 research papers in national and international conferences and journals. Her research areas are Medical Image Analysis and image processing, Natural Language processing and Machine Learning. she has one patent registered and also, coordinated Skilling program under TEQIP, organized various workshop/ talk / event/ in department. she is well prepared for dedicate himself highest standard of instruction at esteemed institution.

Mr. Nagaraj B Kalligudd (MTech) is currently Working as an assistant professor in the Atria Institute of Technology at Department of Computer Science and Engineering Bengaluru and graduate from Basaveshwar Engineering college, Bagalkote. He has worked in IT sector over 10 years and completed his Master in Computer Science and Engineering at East west institute of Technology Banglore. He had organized various workshop/ skilling program/ Events for students/ faculties under IDEA lab at Basaveshwar Engineering College. He is well prepared for dedicate himself highest standard of instruction at esteemed institution and exceed your expectation.