

An Automated Unit for the Detection of Accident using Fuzzy Logic and IOT

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Abstract: *The accidents that occur from local roads to highways will cause a huge damage to human lives and also economical impression. The minor accidents do not impact on the lives and these can be resolved by the victim and there is no use of police and rescue team for saving the lives and wasting the valuable time. The problem arises in detecting the major accident and delivering the emergency services to victim. The Automated system is a system that furnishes the detection of the accident and checks the chances of accident and sends the data to the users who are connected to local server. The users get the information regarding the status of accident, latitude and longitude through the connected local server. The idea is that whenever the vehicle meets an accident, the details should be received to police and nearby hospitals so that the lives can be rescued from danger. The proposed system involves the implementation of fuzzy logic as a decision supporter in analyzing the data received from sensors and predicting the extent of accident with good accuracy based on set of rules.*

Index Terms: *Fuzzy logic, extent of accident, GPS and Open source IOT platform*

I. INTRODUCTION

Accidents which are sudden unexpected things that happen in life and can change the fate of a life within a fraction of seconds. Accidents can cause huge damage to not only humans but also to the property and economy. The accident not only gives spot dead situations but also gives disability to those people who injured in the accidents. When accidents are occur immediate requirement is to provide a first-aid emergency service to those people and can make their lives better. The survey conducted by “National Crime Records Bureau, Ministry of Road Transport & Highway” stated one serious road accident in the country occurs every minute and 16 die on Indian roads every hour, two people die every hour in Uttar Pradesh – State with maximum number of road crash deaths and Tamil Nadu is the state with the maximum number of road crash injuries. Day by day the count of accidents and the number of people being injured are increasing. As per the survey the teenagers and young people are dying majorly in the nation. Similarly, the cost associated with fatalities and deaths were staggering in the United States. Research shows that the monetary cost associated with non-fatal injury victim was approximately \$111,870 and \$708,235 for a fatal injury. The

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State of Tamil Nadu has recorded highest number of road accidents in 2017, but the number of persons killed in road accident has been highest in Uttar Pradesh. The cost of accidents is approximately \$8 billion annually in India which is approximately equal to 3% of GDP.

The reasons for occurring of an accident are over speed or rash driving, not wearing helmets and car belts, drunk and driving, teenagers who does not have license and overtime duty of some drivers. Traffic rules are not followed at some places which may lead to death of their lives. Some metropolitan cities like Mumbai, Chennai, Delhi, Visakhapatnam and Vijayawada follow the rules strictly but some of the cities which are turning to metropolitan are not following the rules. The speed limit boards in India are for namesake only because the systems do not monitor the speed of vehicle, they are just caution boards on roadsides. The government of India should make prompt and sound decisions in the rules and regulation of traffic which saves the lives of future generations. The problem occurs after an accident is occurred. We are failing in finding the location of accident and providing the immediate first-aid. The accident may occur at less density areas which lacks in knowing of an accident. The idea behind the implementation of project is to save the lives of humans who met accidents and providing the accident data to police and rescue team. The automated system helps in detecting and notifying whether the accident has been occurred or not. The system setup must be installed inside the car and the detection of an accident is based on the Mamdani fuzzy logic that evaluates, using three parameters (force, acceleration and rotation) to calculate the extent of accident and sends the data (accident status) and the position of the accident to the users who are connected to the local server. So, the users can access the data from server and can check the status. This system eliminates the need of people to intimate the information to police. The paper is aligned as follows: Section 2 illustrates the related work and scope of the paper. Section 3 describes the design of the automated system with the help of architecture of system. Section 4 explains the implementation of the proposed system. Finally; Section 5 concludes the paper and also provides the future extensions possible to current work.

II. RELATED WORK

A few scientists have been presented in the equivalent field of research. The thought has been introduced to the world at numerous events yet the absence of execution, finding the perfect area for the framework or different



issues have limited the boundless employments of the thought. Several research works are carried out and still work is going on in designing the automated system in different ways. The idea was proposed by many researchers but lack of implementation is not coming to action due to the installation of setup in the vehicles.

The automated design for accident detection in which the driver residing in the vehicle must own a smart phone so that the application in the smart phone which was a fuzzy logic based decision support device will calculate the extent of accident and predict the level of accident that has occurred. The information regarding the mishap is sent to the smart phone by means of Bluetooth module. After knowing the extent of accident, a text message from the mobile phone is sent to the predefined number. The drawback is that the driver must maintain a smart phone [1].

An accident detection system using dynamic fuzzy logic controller. This paper will explain the concept of using the fuzzy logic and the parameters that can be watched by means of membership functions and here the dynamic fuzzy logic was based on the zone basis which means taking one particular area and the time where traffic will be more. These constraints were taken into account while building the logic [2].

The system with a microcomputer which was Raspberry pi along with Wi-Fi or internet. Instead of using a smart phone for texting a message, the information can be sent to the user by means of Wi-Fi controller. Raspberry pi which works at high speed than Arduino is an advantage for this project but Arduino is preferable in this project because the equipment is simple and the interfacing is simple with Arduino. Raspberry pi is used for high end applications as it is a microcomputer. The cost is also an important parameter in designing the project. There can be lack of accuracy because of single threshold value [3].

The automated design by using Mamdani fuzzy logic. This paper clearly explains the fuzzification, linguistic variables, crisp logic, fuzzy logic, fuzzy rules, defuzzification, extracting the crisp values from fuzzy values. The advantage of building the fuzzy logic based on Mamdani logic helps in providing the better results to human inputs. The membership functions were explained with formulae and the membership functions are the graphical representation of the input and output variables [4]. A survey paper which illustrates the accident control algorithms such as Control optimization algorithm, Auto tune algorithm, Adaptive charged system search algorithm which improved the efficiency of the system by implementing these algorithms and the accidents can be minimized to a major extent [5,9,10]. An implementation of traffic light controller using the fuzzy logic which helps in providing the route for injured people by clearing the traffic as every second is precious [6]. The system without a programming processor, they designed the system with ARM7 microcontroller and interfaced the sensors to controller and usage of GSM modem to send the information to the user [7]. The design using IOT for message alerts. But the accuracy cannot be achieved as the traditional values are taken into account rather than extent of accident [8].

The further advancements in the field is incorporating the number of sensors like alcohol sensor module, vibration

sensor module and a LCD display to know the level of accident beside the accelerometer display. The another possibility for GPS is by including alternative navigation systems like the Russian GLONASS, the EU's Galileo system or China's compass system. The surveys helps the implementers in giving the analytics of present scenario and the design will be made according the reports which helps in overcoming the problems in current society.

III. AUTOMATED SYSTEM DESIGN

If Fig. 1 shows the sketch of proposed automated system and the input parameters to the embedded processor are the acceleration, gyroscope and force sensor which will be received from the input module sensors. The data obtained will be processed in the embedded processor. The fuzzy logic based decision support algorithm will be implemented inside the processor. Based on the designed logic and the extent of accident is calculated and the information related to the status of accident is provided to HTML web page. The users who are connected to the local server can receive the data related to the accident and can note the longitude and latitude and more over a link which takes the page to the Google maps application to know the exact location of the accident and can send the rescue team and primary first aid to the injured people.

A. Input Unit

The input unit scans the sensor module data and carries the received information to processor. The components of the input unit are:

Accelerometer: The triple axis accelerometer is a part of Micro-Electro-Mechanical System which is the miniaturized sensor which calculates the acceleration value. Each vehicle has accelerometer from which we can know the speed of vehicle or the accelerometer wire can be connected to the triple axis sensor.

Gyroscope: The Gyroscope detects the pivot/tilt of the vehicle and peruses the information in the wake of handling in degrees per second. This rate of pivot is utilized for assessing if the vehicle has turned to its side or flipped totally.

Force Sensor: The four power sensors situated at each side of the vehicle recognize the effect power of the mishap.

B. Embedded Processor

The Embedded Processor assumes the job of an interpreter. It incorporates a flag preparing module that examples the aligned information consistently, and a ESP8266 module that sends the aligned information to the webpage. What's more, utilizing the readings of the accelerometer, the speed of the vehicle is determined and utilized by the choice help part in the logic. Also, the accelerometer readings are changed over from its crude qualities to g's while the whirligig readings are changed over to degrees/second.

Fuzzy Logic Decision Support: The choice help is in view of Mamdani Fuzzy Logic that utilizes four info factors (accelerometer, spinner, power and speed) to assess whether a mishap has happened or not. Each variable is made out of three territories;



low, medium and high. This makes distinct mixes of information sources that are utilized by the choice help to assess a recognition situation.

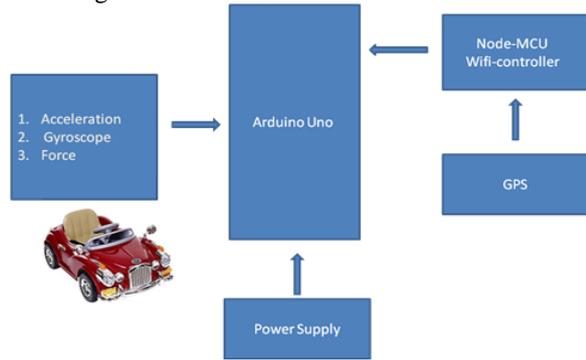


Fig. 1: Architecture of automated System

The fuzzy logic decides the whether the mishap has happened or not. Rather than using the fixed the edge esteem utilizes measurable thinking, particularly when managing with marginal qualities. The fuzzy logic considers all factors and the combinatorial yields and puts together its choice with respect to the criteria that are met. Table 1 demonstrates an example of the unique mixes of the fuzzy logic.

Table 1:Fuzzy Logic Rules

Acceleration	Gyroscope	Force	Collision
L	L	L	L
L	M	L	L
L	H	L	H
M	L	L	L
M	M	L	H
M	H	L	H
H	L	H	H
H	M	H	H
H	H	H	H

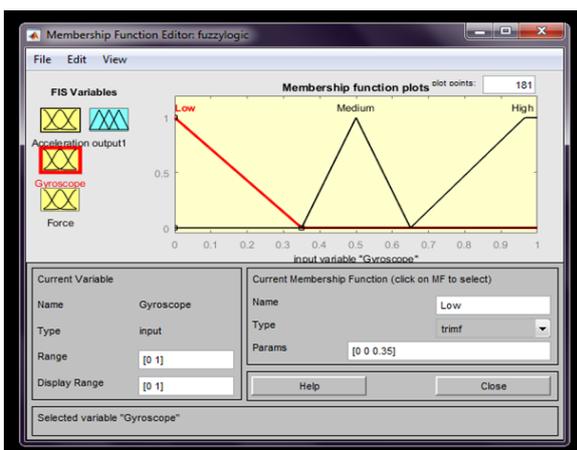


Fig. 2: Membership Function(Gyroscope)

C. Response Unit:

The reaction module is capable for getting the choice help to send an instant message to an outsider (crisis contact/open security). The instant message incorporates the GPS area, the time and the date of mishap. The content messages can be utilized to check the information of the capacity. The response

unit has a Node-MCU which has local server and a maximum of eight users can access the data of accident status. The users can access the information through a IP address which a web page with a tabular format using HTML and also provides a link which leads to Google maps application so that the user can know the exact location of the incident. Not only the user but the nearby police and rescue team.

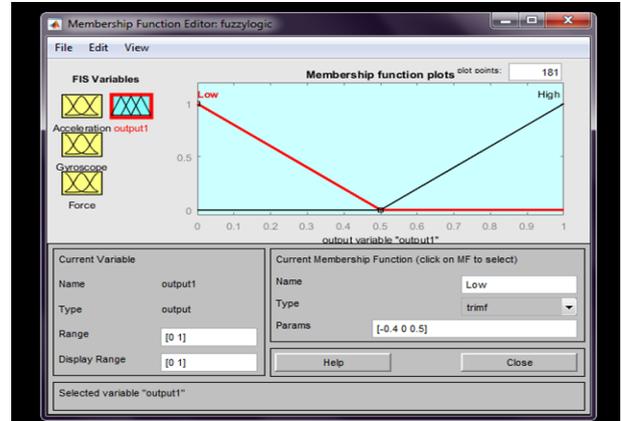


Fig. 3: Membership Function(Collision)

IV. IMPLEMENTATION OF AUTOMATED SYSTEM

The The execution engineering, is made out of a MPU-6050 triple hub accelerometer and gyro breakout to gauge the speeding up and revolution of the vehicle, Force Sensitive Resistors (FSR) that are connected at the closure of the vehicle to distinguish sway power of mishap, a Node-MCU Module to send information to the users through a webpage, an Arduino board to peruse the sensor information, control the wifi controller module to send information to webpage, condition and process the sensor information. It additionally includes a local server where a maximum of eight users can connect and give the GPS arranges through the Network Provider also, send an instant status if there should arise an occurrence of recognition of a mishap.

The hardware of the proposed system is comprised of following equipment:

- Arduino Uno
- Triple axis accelerometer and gyro breakout
- Node-MCU wifi controller
- Global Positioning System(GPS)
- Force Sensitive Resistor

The fuzzy logic is implemented by using Mamdani algorithm which is intuitive and have wide spread acceptance and are well suited to human inputs. The performance evaluation is quite more accurate and being the basic algorithm, it can be easily understood.

With respect to the product advancement, the accompanying software's were utilized:

- Arduino IDE
- MATLAB R2016a

V. CONCLUSION

This paper presented an automated system that saves the lives of humans and allows taking immediate action and preventing the accident as much as possible both human and economic. This helps in knowing the location of accident and provides immediate emergency services to the injured people. The accident data will be available to police control room, rescue team and family members.

Moving forward from the prototyping further improvements can be made to the system. The hardware can be optimized to be more compact to be installed into a vehicle. The accuracy can be improved by using the algorithms. This system uses a webpage which is connected to local server and a maximum of eight users can be connected to local server and these eight servers can know the status and location of accident. But in an extension to this we can create a website and can be accessed by any user on globe by making the server as global server. Any number of users can access website by placing in global server.

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