CHAPTER-2

LITERATURE REVIEW

The Chapter discusses the literature review which has been carried out for studying the existing technologies and finding the problem statement from the research gap. The various papers on already existing technologies for preventing the head injuries on occurrence of the accident along with reasons of the accidents are referred from reputed journals. The need of current research presented in this thesis is also concluded from the literature survey.

2.1 Findings of Literature Review

A. Geetha et al [1] proposed a Zigbee based supervisory system with voice for coal mines. The system design also includes environment monitoring can communication with control room.

Application of Zigbee as system for coal mines is discussed but other applications are not discussed.

Alian, Sahar et al [3] describes a study on crash rate in accidents and the effect of road conditions and behaviour of driver on it, in Australia. Paper concluded that the study of road geometry with time of day/night must be considered for crash analysis to set the data for national survey.

Paper considered the road geometry and time of accident as parameters to be considered for the road accident survey but methods for prevention injuries are not discussed.

Anita et al [8] proposed a novel approach for two-wheeler to drive safe. The system is designed such the driver will not be able to start vehicle unless he/she wears the helmet. In case of accident the system send the message to predefined number with the location. The system comprises of Iris sensor so that only authenticate person can start the vehicle.

Paper suggested a new approach for safe driving on two-wheeler and then emergency message on accident but calculation of finding the threshold values from sensors in helmet is not discussed.

Gehlot, Anita et al. [9] described a WPAN and LabVIEW based system for monitoring the water quality at home through RF modem. The designed system is capable of giving the early warning for the contaminated water.

Author discussed the role of WPAN and LabVIEW in real time monitoring systems but other applications are not discussed.

Atıcı, C., et al [10] discussed about the components required to sense the environment and proposes a test bed deployed on street lights and concludes challenges and research directions to design intelligent road lightning system.

Paper concluded the challenges to design any intelligent system and application of intelligent road lights is discussed but other applications are not discussed.

Hollinger, Avrum et al [11] said that the design parameters of FSR sensor are its minimum and maximum value of resistance and correlation of data from these sensors are taken as reference with defined value. This creates [46]a data acquisition system for measuring pressure inside the Helmet when rider wears it.

Papers discussed the role of FSR sensor in measuring pressure inside the helmet but its actual implementation and results are not discussed.

Batool Abida et al [12] described the biometric based security system discusses about new and existing security systems and concludes reliability of biometric system.

Paper discussed about the biometric based security and its reliability but not about the application.

Chowdhury, Belal, et al [13] suggested the wireless identification and sensing platform to perform sensing and operating the RF energy.

Author discussed the RF energy and platform to measure it but its applications are not discussed.

Ben-Bassat et al [14] discussed about the safety program named "Zahav Bagan" conducted by senior citizens for kindergarten children. The target was to observe the behaviour of the parents who has gone through program on safety of kindergarten and who doesn't opt for the program. Result observation shows no change in the awareness of parents on road safety laws, but they show more awareness towards the safety.

Paper was about the observation of parent's behavior after training program on safety but it is not giving solution to the persons those who are avoiding the safety laws.

Buckley, Lisa, et al [15] collected statistical data for motor cycle crash in Michigan during year 2012-2014. Study on helmet use and its characteristics was carried out. The aim was to increase helmet use for the motorcyclists because avoiding it results in serious fatal and non-fatal injuries.

Paper was based on the statistical data collected for bike crash and promoted the importance of wearing helmet but not giving any solution in form of an improved system.

Ko, Chien-Ho. et al [19,43] suggested a system with RFID and FSR sensors, to avoid the accidents happens due to negligence of two-wheeler rider. To recognize human activities and maintenance of injuries due to accidents, sensors have proven helpful.

Paper proposed RFID and FSR sensor based system for avoiding head injuries after accident but the analysis with FSR is not discussed.

Houston, David J et al [21] discussed the statistical data on the study of the effectiveness of universal helmet law for a period of 1975 to 2004 on the six states of US. Results shows the extra 615 fatalities of motorcyclist due to changes in the helmet laws.

Paper showed the statistical data for effectiveness of helmet law in US but it is not giving any solution to the problems in implementing laws.

Fernandes e. al [24] explained about the concept of wearing helmet while driving two wheeler. New material and methods with new design are proposed. Paper also discusses the test standards for helmets.

Author proposed a new design of helmet as per the standards but doesn't discuss the methods of implementing the helmet wearing rule at large scale.

Fengzhong Qu et al [25] introduced an integrated intelligent transportation spaces with pedestrians, vehicles, road side infrastructures, traffic management, sensors and satellites, to analyze possible communication technology. The system is designed to improve efficiency and sustainability of ITS.

Author discussed about possible communication technologies only for ITS not for other systems required for road safety.

Hua Qin et al [28] described the integrated vehicular ad hoc network with wireless sensor network, by deploying sensor nodes along the road side, to sense the road conditions. The system gives information about bad conditions of roads to avoid dangerous conditions, for safe driving.

Author discussed the Ad hoc network and WSN based road monitoring systems but sensors required for sensing the accidents are not discussed.

Lee, J. K. et al [30] suggested that the finger print authentication can provide new solutions for eliminating the accidents which occur due to negligence of untrained bike rider.

Paper suggested finger print based authenticate solution for two wheeler but real time analysis of system is not included.

Ratha, Nalini K. et al [31] concluded that the synchronization is required between the pressure sensors and the finger print sensor to ignite the bike. It is [28] done by wearing the helmet and giving a match fingerprint through which a valid user can ignite the bike.

Papers suggested the combination of pressure sensors and finger print sensor to ignite the two-wheeler only if driver is wearing the helmet but real time implementation and sensors data analysis is not discussed.

K. Sudarsan1 et. al [32] suggestted a system to send a warning signal to rider of bike to wear helmet when hazards is ahead. System also includes a MP3 player to listen to music while riding .

Paper was about sending a warning signal to bike driver when hazard is ahead but don't make sure that the driver is wearing the helmet or not.

Latha Ganti et. al [38] discussed the impact study of the helmet after vehicle accident. The study has been done for two wheeler like bicycles, motorcycles, scooters and also for skateboards. Results shows the riders without helmets having more serious injuries.

Paper was about the impact study of helmet after accident but doesn't give any solution to prevent the accidents.

Li Lian et al [39] discussed the intelligent wireless dimming system for street lights by using Zigbee and GPRS. The system is compared with existing wired system and analysis shows enhanced performance of the proposed system. Results also show that the proposed system is having low cost, low power consumption and less complexity than existing technologies.

Paper discussed application based on Zigbee and GPRS in wireless dimming system but not for monitoring the accident prone areas.

Sosin, Daniel M et al [41] discussed a study from 1979 to 1986 in United States about the helmet laws and its impact on head injury prevention. The statistical data shows that with helmet law in a region the death rates are lesser than without law, regardless of the population and motorcycle registrations. The disagreement on laws has also been observed.

Paper discussed the helmet laws in US and its importance but it not giving solution for implementing these laws effectively.

Mei-Wen Li et al [42] described a new timer based mechanism protocol for lost messages, for electronic toll collection, to avoid error rate with only using WSMP. The proposed system provides better reliability.

Paper discussed the application of WSMP for electronic toll collection but not in the accident prevention systems.

Darianian, Mohsen et al [45] explained that the resistance of pressure sensor decreases towards zero when force appears on it and when there is no force sensor provide a high resistance value. RF [60] technologies are more attractive to many of the application domains.

Paper defined the methods to measure pressure sensor values but the real time implementation and application part is missing.

Reinhard Müllner et al [47] proposed a Zigbee based low cost smart lightning system, which is capable of detecting the human being presence and switch off the lights when not required. The article shows system uses less power as it is switched off when not required, also limit the releases of toxic gases.

Paper proposed smart lightning system for a room based on Zigbee but importance of Zigbee is not discussed.

Rana, N. K. et al [48] proposed a system which creates a collaborated environment of Helmet and Finger print sensor which ignite the bike only after wearing the Helmet by the rider. The methodology used is based upon the comparison of measured data through sensors inside the Helmet.

Author suggested a combination of finger print and sensors to ignite the bike only after wearing helmet but the result analysis of sensors and placement criteria were not discussed.

Prabhakaran, N. et al [49] discussed an automatic wiper system during precipitation, which reduces the number of accidents due to distraction of driver for manual adjustment of wipers.

Paper offered an automatic wiper system in four wheelers to avoid accidents due to distraction of driver in manual adjustment but it is not giving solution for two-wheelers.

Li, Nan et al [50] suggested the implementation of RFID based technologies to provide the necessary information. The RFID based technologies [11] gives information which is of great help to the building and improving the utilization and maintenance of facilities.

Papers suggested the role of RFID technology for improving the facilities in a building but not for the safety point of view.

Omar Tayan et al [52] discussed the methods of authenticity and elaborate a hybrid approach with zero watermarking and digital signature.

Author discussed the authenticity methods and new approach in this field but its application part is not discussed.

Sample, Alanson P., et al [54] described a system comprises of RFID technology and FSR sensors for bringing the automatic ignition system.

Paper proposed a FSR and RFID based automatic ignition system for vehicle but real time analysis of system is not included.

Anuradha et. al [55] proposed a vehicle tracking system based on zigbee protocol. The system comprises of the RFID tags to provide each vehicle the unique ID. RFID readers at appropriate locations needs to be installed and whenever the vehicle crosses RFID reader, the information about vehicle is sent to the control room using Zigbee.

Paper discussed the role of RFID as unique ID to each vehicle to locate it but other applications of RFID in vehicles are not discussed. Also it suggested Zigbee based vehicle tracking system but safety methods are not considered.

Zhou, Shouqin et al [58] discussed that the sensor reading directly infer the human activity which is achieved by wireless identification and sensing platform. RFID technology was employed to form a remote system for monitoring the bike rider and used for real time data collection and synchronization with bike section.

Papers suggested RFID technology for monitoring the bike riders and real time data collection but safety device for the rider was not discussed.

Singh, R. et al [61] discussed about the environmental pressure monitoring system to identify the tidal range in danger zones with the help of piezoresistive pressure sensor and Zigbee based wireless Sensor Networks (WSNs). The system was designed using AVR microcontroller.

Author described a Zigbee based WSN with pressure sensor for environment monitoring but other applications of pressure sensors are not discussed.

Richmond, Sarah A., et al [63] discussed about bicycle skill training program for young people of age less than 19 years. The target was to study the

effect on bicycle related injuries after training. The study shows eight of 16 reported the significance gain in knowledge that results in improvement in skills after training program.

Author discussed the importance of training programs for young people on effect of bicycle related injuries but it is not giving any solution for preventing the injuries.

Hall, Rick S., et al [64] suggested the intelligent Helmet and finger verification for more secure and reliable system.

Author suggested finger print verification for security with smart helmet but real time implementation and its analysis is missing.

Vignesh et al [74] explained XBee based wireless sensor network with Arduino to prevent traffic collision. The location of vehicle is traced using "triangle" algorithm and information is sent to mother controller and if speed of vehicle is high message is being sent to vehicle controller to reduce the speed on the bases of positions and status of all vehicles.

Paper explained the traffic collision prevention system but not giving any solution to the prevention of injuries after collision or accident also doesn't discuss the importance of wearing helmet.

Wen-Tsai Sung et al [80] suggested wireless monitoring of industrial applications at remote locations with combination of embedded system and Zigbee. The system also discusses statics and analysis of measured data.

Authors recommend Zigbee for monitoring remote locations for industrial applications but not for the vehicle systems.

Florez, J. [25] elaborated the techniques to use inexpensive Force-sensing resistors (FSRs) to correctly measure compression force. Paper described the methods to measure FSR but not discussed its application.

Zhu, Hongsheng et al. [27] described a wide variation of the sensor data characteristics inside the helmet and average value of the data from these entire sensors can be taken as the reference value.

Paper described the characteristics of sensory data inside a helmet but real time implementation and results are not shown.

Muelleman, Robert L. et al [34] had a study on number of serious head injuries in Nebraska and Midwestern states with helmeted and unhelmeted motorcyclists. The study concluded that the serious head injury with helmeted motorcyclists were 5% lower than unhelmeted.

Paper concluded the study of head injuries for helmeted and unhelmeted people after two wheeler accident but gives no solution for the issue.

Winn, Gary L. et al [37] discussed about bicycle safety module to encourage people for wearing helmet by demonstrating the knowledge with the help of students. It was observed that during BSM helmet usage improves upto 100% but fell down after it was over.

It has been concluded that a periodic orientation programs are required to encourage the people for safety issues.

Author stated the necessity of orientation programs on wearing helmets but do not give any solution to the people who are not considering helmet as important part of bike driving.

Morley Jr, Robert E. et al [46] described a pressure sensor based system to ignite the engine after getting the value more than predefined values in the program, with known pressure values taken and used.

LabVIEW GUI [27] was developed to display all pressure sensors values as real-time bar graphs or as analog pressure versus time curves.

Papers suggested pressure sensors value for igniting the engine of two-wheeler and LabVIEW as real time data acquisition time, but actual calculation of threshold value for igniting the engine is not discussed.

Paul Grady Russell et al [57] invention was related to wireless link between portable entertainment system with two-wheeler and helmet. Helmet having facility to convert digitized audio signal into analog signal, but with distance from ears of rider, and allow rider to listen to traffic signals as well as music.

Patent was about wireless entertainment system in a helmet allowing driver to listen the music while driving but importance of wearing helmet was not discussed.

Brown, Daniel R et al [59] suggested that a fingertip tactile sensor can be used to detect normal force. To sense [16] the presence of Helmet wear by the rider four FSR sensors are placed inside the Helmet.

Author suggested FSR sensors to measure the pressure inside the helmet to detect whether driver is wearing it or not, but the limitation of FSR is not considered.

Shankar, Venkataraman et al [73] addressed an issues related to variables considered for analysis of motorcycle crushes and concerns about prior research contents. It focused on five levels which need to be considered along with helmet use. Author discussed about different parameters to be considered for motorcycle crush analysis but is not giving any solution to the results.

Zhao, Yiyang et al [84] suggested a safety equipment with FSR sensors to ensure the person wears helmet. These sensors are implemented with the two parameters which are maximum resistance and minimum resistance.

Author described the behavior of FSR for security equipment but not discussed its limitations as pressure measuring sensor.

2.2 Observations from Literature

Referring to the literature on accident analysis, preventions, sensors and communication media following observations are concluded-

- Study on increase in no. of deaths due to not wearing helmets and the effect of road conditions are analyzed but no new system is proposed for safety of driver.
- Helmets with additional features like bluetooth call receiver and music system are introduced, but no additional features for safety are proposed.
- RF communication is low cost solution for less coverage area with less power consumption as compared to other communication modules available in market.
- Zigbee uses free band for communication which require no licence and is being used for many applications required for smart cities but its application in safety system for vehicles is not discussed.
- Importance and reliability of biometric security systems are discussed in different applications but Research Gaps are not considered.
- RFID is considered as authenticity device as it assign a unique ID to each user in form of RFID tag.
- Flex sensor output changes w.r.t change in strain and can be used in vast area of applications.
- On the basis of the literature survey components to design the proposed system are selected.

2.3 Chapter Summary

The chapter discusses the already existing art by referring various research papers published in reputed journals. It includes the conclusion from existing art and research gap to define the problem and its methodology. It is concluded that it

is required to find out a safe and authenticate solution to save lives, due severe head injuries caused by not wearing helmets while driving two-wheeler. Further is concluded that RF communication works in free band and consumes less power so same is proposed for and inter-system communication. The proposed system could be a part of smart city approach for new generation.