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Smart Helmet for Industrial Workforce - A Review Paper

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Abstract: The impact when a construction worker involves in an accident without wearing helmet is very dangerous and the effects caused can be fatal. Numerous lives can be saved if emergency medical service can get information about the accident and reach to the scene on time. To resolve these current issues, developing a smart helmet is the best solution which can minimise after effects such catastrophic events in future. The main purpose of a smart helmet is to ensure safety of the construction workers in the working environments. This is implemented by using prominent menace causing attributes which are likely happen by workers or the environment, to address these concerns alcohol detection, location tracking, CO\CO2 presence, oxygen deficiency, fall detection, SOS (accident identification) are used. In our project it's mandatory for a worker to wear helmet before engaging in any work at construction site. If worker is drunk or if any accident takes place, then the prototype automatically sends the information to the management with their current location and health status.
Keywords - Helmet, safety, sensors, GPS, alcohol, accident.

I. INTRODUCTION

This paper provides an overview about the smart helmet prototype mainly designed for industry labourers. Preliminary job of Smart helmet is to safeguard the construction laborers from hazardous events caused by worker himself or due to working environment and prevent them occurring in subsequent occasions. Smart helmet monitors various parameters for worker safety using different sensors which serves for each purpose and the data generated and acquired from each sensors are analyse in regular intervals of time. Sensors used are Alcohol detector, Humidity sensor, Temperature sensor, CO/CO2 sensor, GPS sensor, Altitude sensor. The main goal of this project is to harness sharp-witted nature induced by ensemble of different sensors for accident detection measures taken for prevention and if occured any the notification will be sent to the concerned people. This is achieved using IOT architecture designed for smart helmet system. Many people have lost their lives because of the lack of communication between worker and rescue management about reporting of accident as the executives would be able to track accurate GPS location of the area where the accident has occurred.

The main motive of this project is to overcome these problems, hence this project has been implemented .Sometimes information of the occurred incident will not able to inform to concerned person at the right time. The primary cause for occurrence of head injuries to the people is because of their own negligence for not wearing helmet in working environment. The reason why most of riders refuse to wear helmet is that they feel uncomfortable and they are delusional about suffocation which likely to cause for wearing it.

For the riders to ease out their feeling about these thoughts, temperature sensor is used for monitoring the constant temperature with the help of thermostat which serves the purpose. The prototype of helmet implemented also have features like GPS , alcohol sensor to detect the alcohol consumption, altitude sensor to measure the position of a worker from the ground level and various gas sensors like oxygen sensor and carbon oxides sensors are used to determine whether it is deficient which required for normal inhalation and in case of later to check presence of those gases which are lethal for workers .

On worn of helmet by the worker, a latch is triggered which monitors each and every move of the worker. When worker experiences any sort of problems or discomfort, he can explicitly press SOS button mounted on helmet which calls out for helps and further assistance can be sought from management.

On contrary when he fails to do the above mentioned, which results on fluctuation because fall of the worker, it will be treated as fall detection and, notification will be sent to the emergency contacts immediately, through GPS the latitude and longitude of either of occurred incidents can be tracked. This helmet overcomes these drawbacks of previous version by sending visual images of the location where the person accident have occurred with the precise location with latitude and longitude and this will be received by management. So it gives clear outlook to save the person .

II. LITERATURE SURVEY

Smart Helmet with sensors for accident prevention by Mohd Khairul Afiq Mohd Rasli , Nina Korlina Madzhi, Juliana Johari,et al, In this paper is directed at the effects happened when a motorcycle rider encounters at a high speed road accident without wearing a helmet whose consequences can be lethal. Wearing the helmet can give us an opportunity to minimise after effects caused due to the accident and its life saving material. Many countries have regularized the compulsion of wearing helmet once they are on road.Considering this as our primary objective, this project is particularly developed to elevate safety of the motorcycle rider. Rider will be cautioned when the speed limit is exceeded than mentioned. To tackle these issues mainly two sensors are used i.e. Force Sensing Resistor for detection of head of motorcyclist and BLDC to determine the speed of the bike. To establish communication between transmitter and receiver circuits a wireless link of 315MHz Radio Frequency module is used. To centralize the process , PIC16F84A mirco-controller is used to control all components of the system. The whole system is programmed such that only when helmet is worn by the rider, motorcycle engine will be ignited and LED will blink when motor speed surpasses 100 km/hr   [1].

An Optimal Driving System by Using Wireless Helmet by K. Rambabu 1, B. Premalatha and C. Veeranjaneyulu ,et al, in this paper the author have used the concept of wireless communication between which is established bike to helmet and bike to traffic signal and speed breaker. The communication mechanism is achieved using ZigBee technology. The system has used Zigbee for wireless communication, alongside with zigbee different wireless communication protocols and radio frequency (RF) protocols have been taken part to achieve the problem statement. They have developed a new protocol of their own i.e. when the rider or driver is driving a bike, if he doesn't know where the speed breakers are situated, by using RF technology he can find out their location on bike and trigger them when necessary. The above protocol is implemented using voice recognition which makes possible for rider to interact with the vehicle. Here they have used Arm-7 Microcontroller which is placed in the bike module. Along with the voice recognition unit which is customized for basic command controls i.e. left, right & stop and records them. [2].

Helmet using GSM and GPS technology for accident detection and reporting system by Lakshmi Devi P, Bindushree R, Deekshita N M, et al , this paper conveys about safety of driver which is very essential for his well being as he is one of core requirement for the society. as the population of people are increasing day by day vehicles counts too are reaching to the peak along with them As a result of that collision of vehicles are occurring quite often, hence the main purpose is saving life of whom met with accidents and this is achieved by helmet using modern communication technology like gsm. along with that gps is used for tracking the location of victim and incident where it has been occurred An effort was made to accomplish mentioned objective by using a RF Transmitter which is customized for requirement as danger Zone indicator circuit.When accident is occurred the circuit equipped with MEMS sensor will be triggered along with activating gps to find the location of accident and SMS will be sent to concerned people To Add on to the idea illustrated, the proposed system is intuitive as it has ability to detect danger and sends corresponding coordinates of the spot to predefined phone numbers using GSM.[3]

Alcohol detection using smart helmet system by sudharsana vijayan , et al, this review paper concentrates on various improvisations which can implemented on a smart helmet. Even in this paper the author emphasizes about the wearing of a helmet while riding or working in construction sites. It is necessary to wear when engaged in above mentioned tasks as it can lessen outcome effects of an accident which could potentially save someone's life. The systems which are already implemented are using various sensors such as FSR sensor which can detect physical pressure, Alcohol sensor for alcohol consumption detection, Vibration sensor, LED for alerts. As for the process control is concerned various microcontrollers are used , such as Arduino, ZigBee for wireless communication, PIC microcontrollers .For transmitting the information about incident occurred GSM is used send message along with location acquired from GPS. Smartness of the prototype can be enhanced by using bioelectric sensors for monitoring Brain and motor functionalities of the rider, Cardiac to check anxiety attacks experienced by the driver and Respiratory Activity if the rider is under influence of a medication. Hence smart helmet is an unique and innovative idea which makes motorcycle driving safer than before and can prevent many road accidents.[4]

Smart Helmet Using GSM & GPS Technology for Accident Detection and Reporting System by Manjesh N, et al, The idea of this work addresses about a smart helmet which is an innovative piece of concept which can make motorcycle rider's life safer than before. The working of this smart helmet is very straightforward, placement of vibration sensors on helmets are pretty intuitive which have highest chances of colliding with surface after the accident is occurred and sensors are connected to microcontroller board for further processing of data. GPS receiver helps in acquiring the location of the occurred incident using GPS module interfaced with the controller and then notification is passed on to concerned people through GSM. System is comprised of P89V51RD2 Microcontroller and various sensors such as vibration, alcohol, and temperature. Solar Cell was used as power supply for the system.[5]

Smart-Tec Helmet by R. Prudhvi Raj, et al this paper deals with current day synopsis encountering numerous cases of motorcycle road disasters which can be fatal. The root cause for being this lethal is due to severe head injuries caused during impact. Even though cost of helmets are economical and their availability is abundant , people are negligent about their use and are ignorant about it. In this regard, the primary reason people are reluctant to wear helmet is because of heat and sweat generated inside which in turn results in uneasiness while driving. In this paper the prototype of smart helmet is designed by improvising the existed idea with Peltier module and GPS which are controlled by P89V51RD2 Microcontroller . After ensemble of the mentioned features to the helmet, stable temperature can be maintained inside the helmet by using Peltier module which works on the concept of thermoelectric effect and LM35D temperature sensor is used. When the rider is met with accident ADXL3 accelerometer sensor embedded inside the helmet sense shocks on impact and the approximate location coordinates of the rider are acquired using GPS. By using GSM modem the message about the incident is passed on to an ambulance, Also if there is occurrence of bleeding , Peltier module can be used for clotting the blood oozing from the wound as a first aid treatment in golden hour which is essential.[6]

Smart Helmet by Kajal Thakare , et this paper talks about the working of the smart helmet using a Microcontroller as centralized part of processing unit and design is pretty simple, they place the vibration sensors were placed in different parts of helmet where vibrations can be easily acquired once the helmet hits on the surface. They were connected to the Microcontroller for further processing. When the rider crashes and the helmet hits the ground, the sensors obtain the data on impact and the GSM module which is interfaced with Microcontroller helps in sending the notification. When the data exceeds minimum stress limit then GSM module automatically send message along with location taken by GPS to concerned people for further assistance [7].

Smart Helmet: Monitoring Brain, Cardiac and Respiratory Activity by Wilhelm von Rosenberg, et al, this paper give a shot at importance of acquiring ECG signals from head region of the victim, who has encountered with an disaster and monitoring cardiac activity aftermath of the incident. It mainly focuses on injuries caused on road accidents , distinctly on head traumas. Most of equipment's are designed to obtain pulses of cardiac activity from limbs, arms, torso and chest regions. On the other hand, Brain function is procedurally measured with specific unit particularly dedicated to serve the purpose. This is unit is comprised of head mounted sensors. The author has proposed a unified system which consolidate both functionalities inside an mere helmet. They have obtained a ballisto-cardiogram by using numerous electrodes assembled inside the helmet where likely the electrodes can make a good contact with skin at different parts of head to obtain the signals. The setup was very promising as it able to acquire useful data about heart rate from jaw region of the head, similarly neural signals were obtained from forehead. Vital signs of most important organs which contributes for survival of any individual were easily noted down from helmet embodied with electrodes . [8]

Smart Helmet by Prof. N. B. Kodam ,et al, The thought of this work is to give data about the rider whether he is wearing the helmet in situation he supposed to be, when the rider has met with a mishap it gives a data about the location of the accident through GSM & GPS module to emergency numbers .[9].

Hi-Tec Helmet and Accidental free transportation system by A viral Ajay, et al This Paper embark on methods which can be implemented to avoid accidents. A GSM module is used with microcontroller and transmitter circuit. Piezoelectric Crystal is used as sensor to detect the vibration and to provide electric signals to transmitter circuit. Microcontroller sends signal to the GSM and GPS with the current location of the person in the form of coordinates. Accidents occurrence can be minimised and prevention can be achieved through analysis of data acquired from sensors whose values changes momentarily to external motions[10].

Smart Helmet Using GSM and GPS Technology by Tushar Raut, , Indrani Nikose ,et al, this paper attends to the welfare and dependability of usage of helmet by the bikers to prevent themselves from danger against road accidents. The author has proposed a prototype which uses GSM and GPS technologies to send messages about the incident and its location. The peculiarity of this prototype is it can measure the alcohol content of the rider if he had consumed some before riding the bike. If the detected alcohol level is more than the predefined value, the alarm starts to beep and notification and location of the rider is sent to the concerned person. [11].

IOT based Smart Helmet for unsafe event detection for mining industry by Jagadeesh R, Dr. R. Nagaraja, et al, this paper addresses about the primary motive for responsible for development of smart helmet to miners. The required to perform by the helmet is to prevent and detect hazardous circumstances which often occur in mining sites. The designed prototype consists of various sensors each of which are assigned with specific tasks. Most important ones are gas detection sensor which helps is in determining presence harmful gases such as carbon oxides and oxygen availability with saturation index for all gases and humidity. When the miner encounters with an accident resulting in fall of the victim, gyroscope mounted on microcontroller is triggered and hence is recorded. The collision of any object to head is collected using pressure sensor. According to head and neck injury criteria, if the force exerted on head exceeds 34 psi, it is considered to be a lethal. The design comprises of two modules- the helmet module which mainly hardware components and reporting (or monitoring) module. The helmet module consists of ARM7 microcontroller at transmitter

end , while raspberry pi is used at receiving side for reporting module. At transmitting side the circuit is synchronised with various sensors and ZigBee is used for wireless communication at both the ends two modules. If miner is encountered with any accident, the reporting module have an unique feature which automatically generates an e-mail and sent as an alert e-mail to authorized personnel[12].

Accident and Alcohol Detection in Bluetooth enabled Smart Helmets for Motorbikes by Sayan Tapadar, Shinjini Ray, Robin Karlose,et al ,This paper focuses about frequency of motorcycle accidents which are increasing day by day because of sloppiness of wearing a helmet and riding while intoxicated by alcohol. In this paper, the author proposed a prototype which can detect amount of alcohol consumed using a breath analyser, data gained from device can be extrapolated further to detect accidents which are mainly to occur because of above mentioned reason. Various sensors are embedded onboard distinctively with a flex sensor, impact sensor generates data when it hits on the ground, ADXL355 accelerometer to measure change in tilt in 3D axes. The data is sent to server through application programming interface such as HTTP, MQ3 breath analyser which is attached inside the helmet is used to senses the amount of alcohol consumed by the rider through his breath, if it is beyond threshold, rider will be reported for driving under influence. Using support vector machine a model to predict future cases is trained from data acquired from reported cases. Helmet can be communicated using smartphone connected via bluetooth and can view the data transmitted through API using Internet. This project ensures safety of the rider while on road [13].

Voice Controlled Smart Helmet by R.,Prashanna Rangan , M. Sangameshwaran , et al .This work give a shot at how IOT technologies can be applied to enhance performance of helmet by inculcating smart features. Occurrence of accident is inevitable it can be caused due to negligence or inexperience, but in both cases there is threat to a person's life. It is very important for passing the information about the accidents along with the precise location to the nearest hospitals available for further aid. This is achieved by using IOT integrated with GPS. Since most of devices in current world uses internet and this can leveraged for life saving purposes . The designed system consists of voice module for controlling various actions in hands-free mode like to turn on indicator while making a diversion, headlights for improving the visibility of the road, horn at an obstacle, and also the ignition system to start the engine, all these privileges are given to the user specifically concentrate to control the vehicle rather than getting drifted away because of stress induced by driving. As the user controls most of the activities over his voice, he should be awake for the entire trip.[14].

The high security smart helmet using internet of things by Mr.Sethuram rao, Vishnupriya.S.M,et al. The main goal of this project is to address about accidents by trying to detect before it occurs, when incident occurred a notification is to sent necessary people for further assistance and measures taken to prevent them happening in future. This prototype installed on helmet makes rider to feel comfortable and assurance just accidents as it have high protection and security mechanisms. The prototype consists of raspberry pi 3 controller mounted on helmet which acts as the brain to the system. As raspberry pi is advanced and compatible to communicate with WIFI based modules, it is networking part of the system.To add-on for elevate communication Bluetooth is interfaced with controller for cloud based services. The helmet is given with an api key which need to be interfaced with both vehicle and the cloud in which , when the rider meets with an accident the scenario can be visualized and sent to the receiver. Sensors will acquire the data and command it to raspberry pi 3. A software application has been created such that it locates the exact position in using Google map. Cloud based services will send messages to receiver contacts and are recorded in database .[15]

III. CONCLUSION

User has to wear the smart helmet for the safety purpose. By implementing this project, which would decrease the head injuries during construction and also detects the alcohol consumption, altitude of a person, location tracking and fall of a person. In case of emergency worker can press the SOS button which is mounted on the helmet. Hence smart Helmet is very important and effective for the safety of the user.

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