

IOT Enabled Industrial Helmet

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ABSTRACT

The prime objective of this IoT enabled Helmet is to reduce communication-based time lags between co-workers of an industry by introducing duplex wireless communication network system. It will also ensure workers safety by enabling one to click SoS calls generation. It also consists of augmented reality display. Along with these functions it is also featured with unique data acquisition system which will help in tracking daily activities of workers. The helmet is also coated with composite materials that will improve its impact resistance by 13 percent. The helmet is useful in versatile fields where communication is frequently required. It will also play important role in injury prone industries.

Keywords: IoT, Helmet, SOS, Wireless communication.

1. INTRODUCTION

The latest trend in technology is IoT, which stands for Internet of Things, The Internet of Things is the fundamental of daily useable items – from heavy machinery in manufacturing industry to simple accessories like Helmet, watches etc – using precise- sensors, which are used to gather data and making decision on that data across a network, It can be used for data interpretation or manufacturing equipment, it can also be used to inform the maintenance personnel for an impending broken machine. We have implemented this technology in our industrial helmet by which we infer different data which can be used for communication purpose, helps in generation of SoS calls, and Maintenance request.

2. INDUSTRIAL HELMET AS A COMMUNICATION DEVICE

Using the concept of full duplex network system and implementing in our helmet helped in creating a network system which generate voice call, the ecosystem generated is described in the fig 1, the below figure explains how the workers of different level connects each other via duplex communication system, ISM band of 2.4 GHz is being used in the module to make calls and generate maintenance requests in an industry.

The figure explains a typical architecture of an manufacturing industry where different level of workers and employee works.

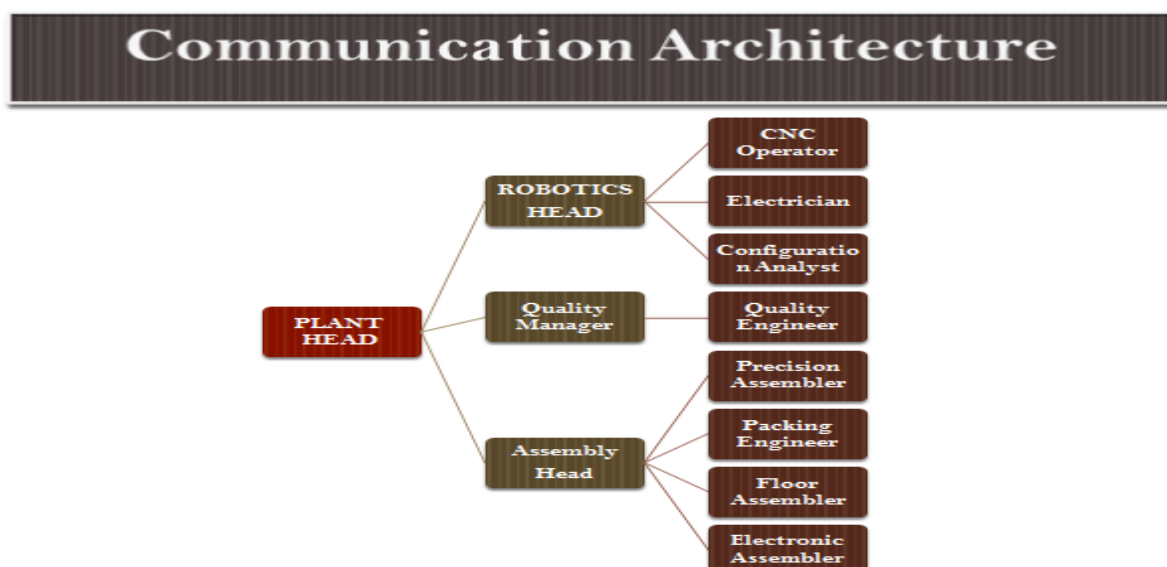


Fig 1 Communication Architecture

Technical specifications of communication module:

The network strength will be between 110 to 150 decibel, it's the best suited frequency for the communication channel, The range of the helmet will cover approximately 800m (radial), the other specs are listed below :-

- Network strength : -110 to -150 db
- System current range : 800 meters
- Speaker db / W : 92
- Microphone sensitivity in : 52 db
- Connection time : 3 to 5 seconds
- Initialization time : 4 to 5 second
- Power consumption active : 60mA
- Power consumption Standby : 15mA

3. CONCEPT OF AUGMENTED REALITY

Augmented reality is the concept that allows us to look things from different perspective, adding multiple numbers of frames of images, digital data and graphics. Just like Virtual Reality (VR), Augmented Reality does not manipulate the present background of the image or introduce artificial environments to replace real with a virtual one. The AR can be visualized in direct view of the user an existing environment and adds sounds, videos, and graphics to the real time.

Our device works on the principal of reflection, it consists of plano concave one sided silver polished device (mirrors) to help human eyes to view virtual images. Some have an “array of small curved mirrors” to reflect light to a user’s fovea point of human eye.

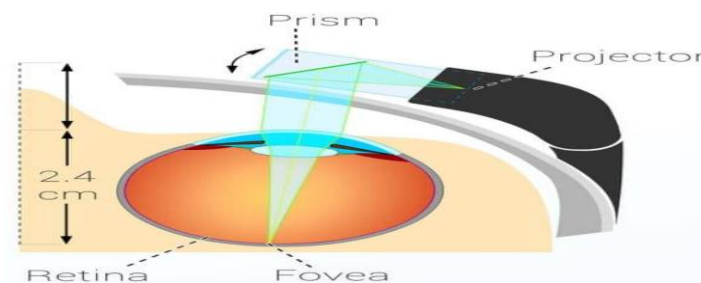
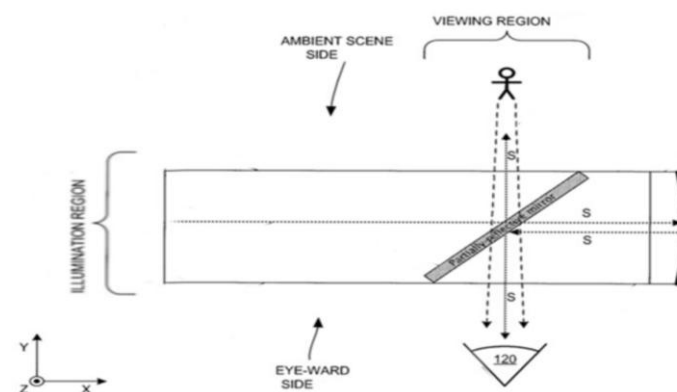


Figure 2 (Working principle of Augmented Reality in our Device)



The screen that is used as projector is 0.94 inches diagonally, it is controlled with a rotary encoder which provides the necessary navigation functions for the user interface that is to be displayed in front of the user, augmented reality will display the status of the employee (Fig 3), a contact page (consist of all the helmets that are connected on a particular network)(Fig 4), the system can also be used for generating any machine failure and maintenance request (Fig 5), the whole set-up will also be helpful in making SOS calls in case of any hazardous situations.

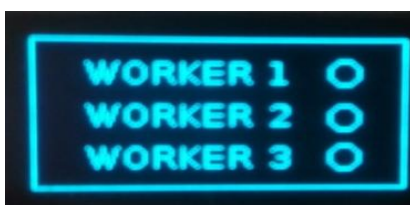


Figure 3

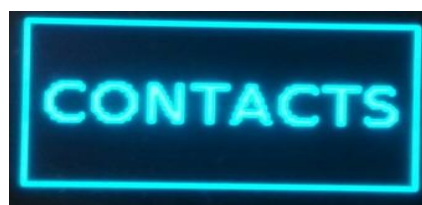


Figure 4

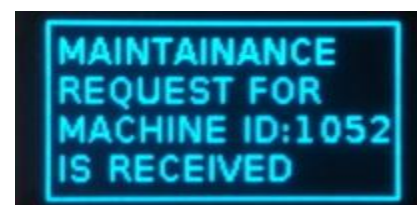


Figure 5

4. DESIGN OF THE HELMET

A helmet must provide protection against heavy impacts, the design must be protecting the worker's head from any kind of a fall or accidental situation. Their structural integrity and resistive capacity are altered in high-energy impacts. Apart from their injury resisting capabilities, their volume and weight are also important aspects, since higher volume and weight increase the injury risk for the user's head and neck. Helmets adapted to the outer structure were invented by engineers at the end of the 20th century.

Industrial helmet are widely used in manufacturing industry, civil engineering and mining industry, our helmet also supports some protective accessories such as a face visors and a torch.

Our design is made up in 6 layers consisting of:

- Inner Comfort foam
- Hard strengthen foam
- Inner ABS layer
- Sandwiched Fiberglass layer
- Outer ABS layer
- Heat resistive nano-material coating

Our design is especially equipped with Duplex communication system, AR display and an Impact sensor at the top of the helmet to detect impact forces, it can generate SOS call to the other connected members of the network and get linked with different safety alarms.

Material used for Industrial Helmet

There are various materials which are used to manufacture an industrial helmet, but due to cheapness, high yield strength, light weightiness and corrosion resistive properties Plastic is widely used. The major synthetic materials that are used are as :-

- Acrylonitrile butadiene styrene (ABS)
- Impact grade Acrylonitrile butadiene styrene (ABS)
- Fiberglass

5. STRUCTURE OF THE HELMET

The structure of the helmet is synchronized with the communication system, augmented reality, The main objective of the robust design is to provide durability, comfort, and efficient working. The below fig 6 shows the complete representation of the helmet structure and it's aesthetics. The figure 7 shows its wire frame design:

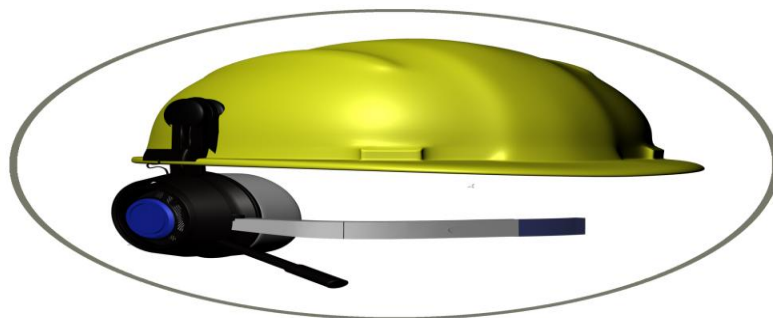


Fig 6 Complete representation of the helmet structure

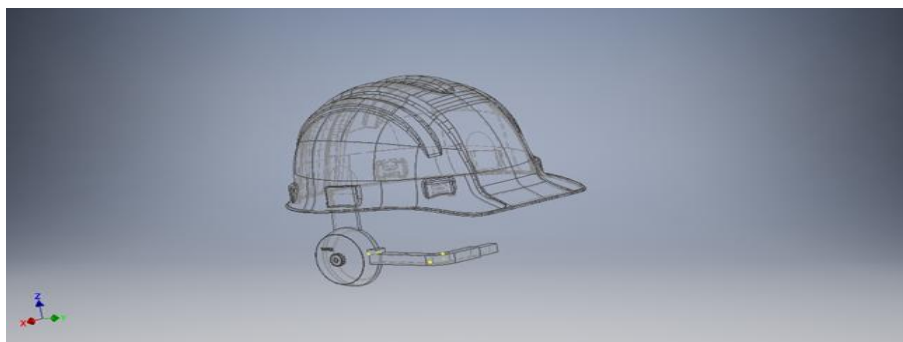


Fig 7 Wireframe model of the helmet

CONCLUSIONS

The IoT enabled industrial helmet can be used in different types of manufacturing industries, where large no. of employee is employed (200-2000 employee). In industries which are involved in mass manufacturing, heavy machinery industry, automobile industries. Apart from manufacturing, it can also be very useful in construction industry where workers are working on heights, construction sites and maintenance area. The helmet will be effective in all the industry where frequent communication is required, the quick and reliable system of SOS generation makes it more desirable in injury prone industry. Simple and attractive augmented display would help supervisors and top-level management for tracking day to day activities of a particular or a group of employees. Overall, the IoT enabled industrial helmet will very useful and will reduce all the communication-based time losses and errors in the manufacturing and civil based industry.

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