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Automation of Traumatic Brain Injury Diagnosis through an IoT - based Embedded Systems Framework

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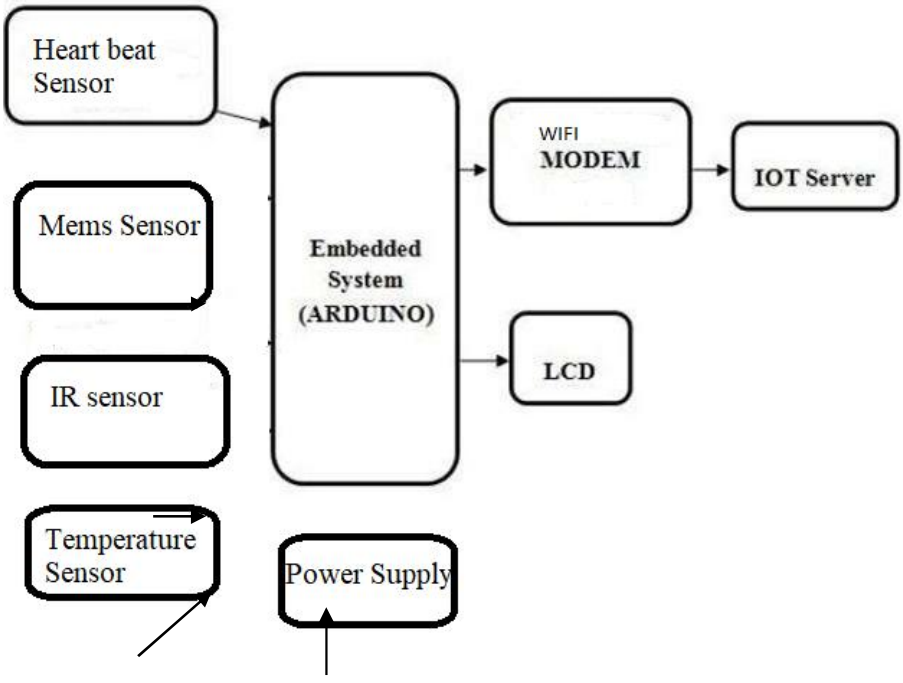
Abstract: *Traumatic Brain Injury (TBI) is a prevalent cause of death and disability with over 3.8 million annual cases and 130 daily deaths in the United States alone. Whenever athletes suffer head trauma, concussion field tests that measure their perceptiveness and cognitive abilities are commonly administered. To solve this, an expensive diagnostic helmet targeting youth sports teams was created, providing quantitative data regarding how much head trauma an athlete has experienced. The helmet is connected to a web-based application system that stores real time data regarding the impact of the head injury, The device and web application were programmed using JavaScript, HTML, CSS, and the Node.js platform in the Intel Edison IDE. This device therefore removes existing bias involved in diagnostics, allows doctors to more accurately handle injuries, and helps ensure player safety.*

Keywords: Traumatic Brain Injury.

I. INTRODUCTION

Traumatic Brain Injury is an acquired head injury caused by a sudden trauma to the brain, resulting in critical and potentially permanent damage to the impacted area. The presence of TBI will depend on the affected individual's height, weight, health, age, and exact severity of the impact, and often leaves the victim with a broad span of enduring injuries and disabilities. Common effects of TBIs include both mental instability and physical health complications such as cognitive impairment, memory loss, nausea, disturbed social interaction, and loss of coordination.

II. BLOCK DIAGRAM



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III. WORKING

- The accelerometer sensor used in this system measures the intensity of the hit and gives an output in terms of "g" Force based on the threshold set.
- The Measured "g" will help for further diagnosis of the patient.
- This diagnosis helps in the place where a person cannot move his body and is in critical condition.
- This system also uses temperature sensor to monitor the body temperature of the player.
- IR sensor is used to detect the presence of player's head in the helmet.
- Memes sensor is used to sense the position of the head and to detect the tilt of the head during a head hit, and such sensed information will be sent to the website and android application (self-developed) for immediate analysis and further treatment

IV. ADVANTAGES

1. Portable system patient is not tether to the huge machines.
2. With this system patient is given portability.
3. As system is portable it runs on battery so no problem of 50 Hz noise and shock hazards.
4. Avoids Serious Injuries and deaths

V. APPLICATIONS

1. Prototyping of Electronics Products and Systems
2. Multiple DIY Projects.
3. Easy to use for beginner level DIY and makers.
4. Projects requiring Multiple I/O interfaces and communications.

VI. CONCLUSION

Through this research, a smart, wearable headgear attachment that has the ability to detect and track head trauma was successfully built. This IoT device is connected to a wireless web application that displays quantitative data regarding the severity, speed, location, and angle of impact in real time and is updated every half a millisecond. The data from this web application is then stored locally on a Microsoft Excel Spreadsheet. Whenever mild traumatic brain trauma is detected based on the aforementioned parameters, an automated text message is sent to local paramedics. This device offers a more accurate and cost-effective solution to standard concussion diagnostic methods. Thus, this device has the potential to save a countless amount of lives and money.