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SMART WEARABLE TECHNOLOGY THAT IMPROVES AVIATION SAFETY FOR BOTH CABIN AND GROUND CREWS

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Abstract: This article aims to predict a level of stress by assessing the individual's activities. This is done through the use of a sensor that is mounted on a glove. The motion sensor selected for this project was chosen as compared to a physiological signal, due to its low cost and the fact that it is least affected by environmental factors. The main cause of accidents nowadays is the increased level of stress on the crew members. The physiological signal measurements using the sensors are mandatory for measuring the stresses of the crew member. This paper presents the concept of predicting the stress level of the crew members based on heart beat rate and body temperature. This is achieved through the use of temperature sensor, IR sensor and heartbeat sensor, which is placed in the gloves worn by the crew members. The GSM module transmits the total readings to the mobile unit. The crew members 'self-reports are used as the basis for estimating the crew members' stress levels. Infrared sensor is used for accident prevention. If there is an irregular condition in the pilot's heartbeat the flight is switched to automatic mode. Then the person's current status is sent out using GSM. The readings of the sensors used above revealed that exact values could be obtained. This shows the need to include the temperature sensor, IR sensor, pulse sensor for tracking the stress level of the crew members.

Keywords—Temperature sensor, IR sensor, Heartbeat sensor, stress monitoring, wearable system.

I. INTRODUCTION & LITERATURE SURVEY

The wearable tech industry is expected to be worth $34 billion by 2020, according to Forbes, with analysts estimating more than 400 million wearable devices will be in use by that time. When most of us talk of wearable devices, there are usually things like Apple Watch, Fitbit and posture tracking in mind. But they also have the potential to help companies improve in areas such as safety and efficiency and no exception is the aviation industry. Today we are exploring how wearable devices can affect aviation safety, from streamlining maintenance with smart glasses to preventing injuries to workers [12]. E.Garcia-Ceja, V.Osmani, O.Mayora[1] developed a framework for "automatic detection of stress from smartphones in working environments." This paper uses the data from the built-in accelerometer of the smart phone to detect behavior correlating with stress levels of the subjects.

"Koldijk, S., Neerincx, M.A.,Kraaij, W[2] developed a system for" Detecting Officer Work Stress by combining unobtrusive sensors. The focus of this paper is on developing automatic classifiers from a multimodal set of sensor data to infer working conditions and stress-related stress on metal. A.Ghaderi, J.Frounchi, A.Farnam[3] designed a "Machine learning-based signal processing system using physiological signals to detect stress." A signal processing approach based on machine learning algorithms is introduced in this paper. Some biological data are collected and feed to the classifier. Then the stress level can be classified into low, medium and high. P.J.Oosen,V.Exadaktylos,D.Berckmans[5] developed the 'Investigation on the mental stress profiling of race car drivers during a race' system.In this paper, the stress level is subsequently transmitted along with GPS information through the cell phone network, so that the driver's location and stress level can be identified. H.Gao, A.yuce, J.P.Thiran[10] developed a system for the "Detection of emotional stress from facial expressions to drive safety" This monitoring system detects the driver's emotional state by analyzing facial expressions. The mechanism considers two specific negative emotions, anger and disgust, as emotions linked to stress.

The concept of predicting the current status of the automated system using temperature sensors, IR sensors and other sensors that are placed within the automated system and made easier[4]. Soft-i-Robot Internet-based security is modeled using soft computing paradigms for problem solving and decision-making in complex and unstructured situations [6]. The model has sensory subsystems such as accident detection, image capture and server sending, and an Obstacle Avoidance can be done via IoT [7], [8]. Automation devices' power consumption must be configured to be low and effective modulation techniques can be applied to decrease power during transmission [9]; Without EMI it is also possible to manipulate high power management better result for the crew members to work effectively without stress [11].

II. TECHNOLOGY AND METHODS

Aviation Maintenance and Wearable's

Google Glass has seen a rebirth in its business-focused Glass Enterprise Edition. A primary application of this technology in the aviation sector is in the area of maintenance operations. Smart glasses provide hands-free access to guidance on how to work. They also allow maintenance professionals to stream live images to remote experts to respond more quickly to questions and to solve problems.The Outcome? Better details, less errors and less time needed to complete requests for maintenance. In fact, GE has shown that the technology has helped to boost mechanics efficiency by 12%.

Wearable's for Training

Another wearable application may come in the form of employee training. Commercial airlines have tested the HoloLens from Microsoft, a form of mixed reality headset that allows users to communicate with holograms to train mechanics from engines. Engine mechanics instruction usually requires textbooks, with hands-on experience limited to jets not in service. With HoloLens, mechanics have the ability to see the engine and take it digitally apart without the need for manuals or aircraft. All in all, it has tremendous consequences for faster training completion, while offering more experiential learning opportunities.

Smart Uniforms

For commercial airlines, Smart uniform could be the future wave for cabin and ground crew applications. A European airliner recently ordered hundreds of LED uniforms to interact crews and passengers with a series of prototype uniforms. The ground operations edition also includes LEDs, plus smart fabric for keeping staff and environmental monitoring sensors dry. Intelligent watches for crews can also become more prevalent. For example, Garmin invented an intelligent pilot watch that provides navigation, weather and flight logging.

Wearables for Workforce Safety

Wearables can also change the way companies handle workplace health in addition to helping to keep the public safer. Wearable devices provide remote monitoring and advanced alerts by security teams based on:

- Toxic gas concentrations, noise levels and temperature.
- Pulse and breathing rate.
- Movements, gestures and activity.

When linked to the aviation Safety Management System (SMS), this data will also provide more information to help prevent and predict future incidents.

Wearables, Data and Security

Although wearable technology definitely has some coolness, some practical concerns need to be taken into account by companies. First, how are they going to handle the large volume of wearable data? Likewise, how can wearable devices are integrated in their operations while protecting cyber-safety? A major part of leveraging wearable information firms will be advanced analytical instruments and data professionals. Given the increasing lack of talent for data analysis, this is a significant factor. Companies may have to think about how to preserve such secure data, such as personal health records related to control of industrial hygiene. They must also safeguard cybersecurity on onboard systems; hackers point out that they can hijack aircraft using in-flight entertainment systems vulnerabilities. Some of the applications discussed here (such as futurist uniforms) may not have been widely accepted for many years, and important safety issues still have to be answered. However, there is no question of wearables ready for take-off in the aviation industry in so far as demand and imagination are concerned.

III. PROPOSED METHODOLOGY

- ✓ The proposed method which utilized the crew members's biomedical signals or speech and lane tracking.
- ✓ This is more susceptible to sound.
- ✓ Galvanic skin response, a well-known stress indicator, is taken along the palm of the crew, which is transmitted via Bluetooth for subsequent processing to a mobile device.

Block Diagram

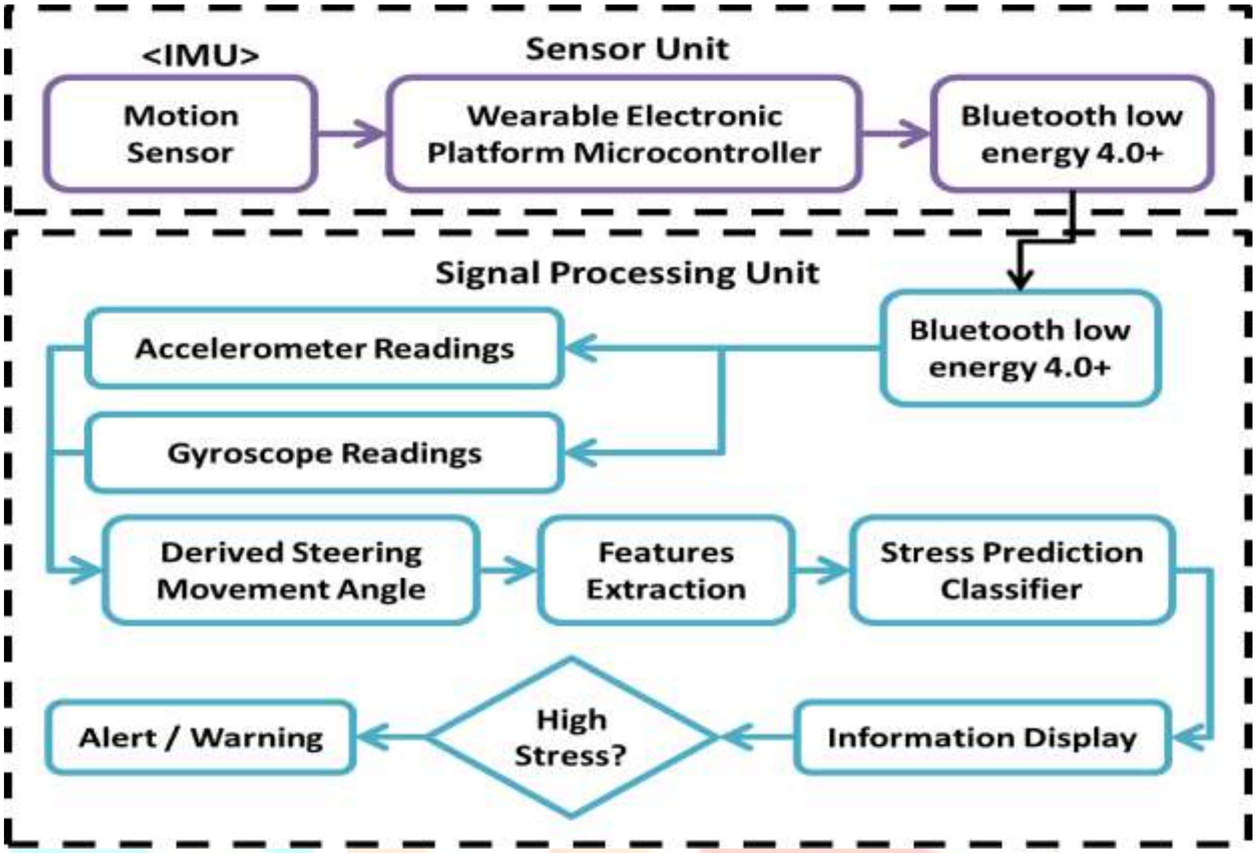

Figure 1: Block diagram of the proposed method

The proposed system as shown in Figure 1 is based on the flight safety warning system concept, which installs PIC controller, heartbeat sensor, GSM modules, and motor and temperature sensor. The temperature sensor initially used for temperature control. Heartbeat sensor that is placed in the gloves is used to measure the pulse rate of the heart; the crew members must wear the glove.

IV.RESULT

To avoid accidents, the proposed system as shown in Figure 2 is designed for the stress detection of the members of the aviation crew. In this PIC16F877A it is used to connect various peripheral hardware. For measuring stress the pulse sensor and temperature sensor are used. Once the crew member abnormality is detected the message will be sent using GSM.

Figure 2: Prototype model of the system

V. APPLICATIONS

- ✓ Used to monitor the level of stress.
- ✓ Used to reduce the probability of accidents.

VI. OUTCOMES

- ✓ This project has presented an original method for predicting a crew members's stress level based on the steering wheel movement derived from a wearable glove motion sensor.
- ✓ The results of the analysis indicated that by incorporating the "redundant" features elimination and stepwise feature selection of extracted features from a motion unit sensor could reduce the SVM stress level prediction classifier's complexity, yet maintaining the prediction rate at acceptable level.

VII.CONCLUSION

Thus it is clear from the proposed system that the stress detection system is performed by measuring the exact heart beat rate and temperature level. Using the GSM module the message about the crew members' status is sent. Therefore it provides good connectivity without failure. The devices used are inexpensive and simple and make the system more efficient.

REFERENCES

[1]E.Garcia-Ceja,V.Osmani,O.Mayora,"Automatic stress detection in working environments from smartphones'accelerometer data:A first step",*IEEE* J.Biomed.Health Inform.,vol.20,no.4,pp. 1053-1060,july.2016.

[2]Koldijk,S.,Neerincx,M.A.,Kraaij,W.."Detecting work stress in officers by combining unobtrusive sensors".IEEE Transactions on Affective Computing 2016.

[3]A.Ghaderi,J.Frounchi,A.Farnam,"Machine learning-based signal processing using physiological signals for stress detection",2015 22nd Iranian Conference on Biomedical Engineering(ICBME) (2015),pp.93-98.

[4] N Rathan, N Vinodhini, A Venkatesh "A smart wearable sensor device for detecting cognitive stress to avoid accidents" International Journal of Information and Computing Science, Volume -6-Issue-3-March2019,Page.No.304-311

[5]P.J.Oosen,V.Exadaktylos,D.Berckmans, "Investigation on mental stress profiling of race car drivers during a race",Proc.ieee 12th Int. Conf. Wearable implant.Body sensornetw.,pp. 1-4,Jun.2015.

[6] N Rathan, A Venkatesh "Design and Implementation of Soft-I-Robot for Face Detection and Obstacle Avoidance Using Neural Networks and Genetic Algorithm" Asian Journal of Applied Science and Technology, Volume 1, Issue 2, Pages 120-126, March 2017

[7] E Krishnakumar, N Rathan et.al. "Automatic Vehicle Crash Detection and Smart Rescue System Using Internet of Things" CLIO An Interdisciplinary Journal, Vol-6-Issue-11 June-2020, ISSN: 0976-075X, Page.No.268-273

[8] N Vinodhini, N Rathan et.al "An Attempt to Design an IOT and Fingerprint Based Smart Automobile Protection System" Tathapi, Vol-19-Issue-05-April-2020, ISSN: 2320-0693, Page.No. 282-287

[9] A Venkatesh, N Rathan, R Saranya "Design of Power Efficient 4x4 Multiplier Based On Various Power Optimizing Techniques" Asian Journal of Applied Science and Technology, Volume 1, Issue 2, Pages 115-119, March 2017

[10]H.Gao,A.Yuce,J.P.Thiran,"Detecting emotional stress from facial expressions for driving safety", Proc.*IEEE*Int. Conf. ImageProcess.(ICIP),pp.5961-5965,2014.

[11] Aswani, Rathan "Home Energy Management System for High Power –intensive Loads" Emerging Trends in Electrical, Electronics & Instrumentation Engineering: An international Journal, Vol. 1, No. 2, May 2014

[12] https://blog.etq.com/how-wearable-technology-can-improve-aviation-safety