**Introduction**

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n today's workplace, employee well-being is becoming a significant part of productivity and job satisfaction. Stress is one of the leading causes of work discomfort and can have negative impacts on physical and mental health. Therefore, the ability to measure and monitor stress-related physiological parameters effectively plays a critical role in creating a healthier workplace.

This thesis focuses on the development of a portable and miniaturized stress measurement device using physiological sensors interfaced with an Arduino Nano ESP32. With the inclusion of a MAX30102 optical heart rate sensor and a Grove - GSR Sensor for skin conductivity measurement, the device can capture real-time biometric readings of stress levels. Such physiological signals provide valuable feedback on an individual's stress response and allow for constant monitoring of well-being during work activity.

The aim of this project is to create and implement a system that not only collects data but also presents it in a useful format through a dedicated application. The application will enable users to real-time heart rate and and skin conductance data. The hardware and software in this project are designed to provide a simple tool for measuring workplace well-being.

To achieve this, the research first explored relevant sensor technologies used to measure stress. This is followed by developing a system architecture that would ensure seamless communication between the sensors and Arduino and data processing and visualization in the app.

By providing a low-cost and user-friendly solution to stress monitoring, the project aims to be a contributor to the new wave of workplace well-being technology and a foundation for more data-based solutions for managing stress.

## **Materials**

## *Arduino Nano ESP32*

The stress measuring device is powered by an Arduino Nano ESP32 which is based on the ESP32-S3 System on Chip. The main reason for using this microcontroller instead of other Arduino microcontrollers is the presence of Bluetooth and Wifi. In this project the Bluetooth is used to wirelessly transmit the sensor data to a smartphone that runs software to present and visualize the stress level and the measurements. Other criteria for choosing this microcontroller include:

* Compact size
* Low power consumption
* Dual-core processor for real-time processing of sensor readings
* I2C interface, used by MAX30102 and MAX30205 for communication

Because it is so compact and energy efficient it is ideal to use in a portable device.

*MAX30102*

The MAX30102 is an optical biosensor that measures the subjects heart rate and blood oxygen level(SpO2) and uses the I2C interface for communication with the microcontroller. Because it is a small sensor with a low power need, it is optimal to use in wearable/mobile devices.

The sensor includes LEDs, photodetectors and low-noise electronics capable of ambient light rejection. Although it contains ambient light rejection, it is still advised to limit the ambient light interference to get the most accurate result. The LEDs consists out of a red LED and an IR LED which are used to extract heart rate and SpO2 using signal processing.

Heart Rate Variability (HRV), derived from heart rate measurements, is a strong indicator of stress level. Which makes this sensor a vital inclusion in the stress measurement. Its compact design and low-power make it optimal for continuous monitoring of the heart rate.

*MAX30205*

The MAX30205 is a body temperature sensor. This sensor has a high accuracy with a precision of ±0.1°C. This sensor, just like the MAX30102, uses the I2C interface for communication with the microcontroller.

Change in body temperature can be linked to stress response. The MAX30205 works alongside the HRV to improve the stress analysis. Combing temperature, HRV and GSR results in a comprehensive stress analysis