ISSN: 2278-4632
Vol-13, Issue-06, No.02,June : 2023

# SLEEP RECORDING AND ANALYSIS USING IOT FOR AID IN INSOMNIA USING THE SMART PILLOW PROJECT

**K.V.N.Sai Suraj**, **R.V. Joel**, **G. Vinay Sai**, Student, Department of Electronics and Communication Engineering, Sreenidhi Institute of Science and Technology, Ghatkesar, Hyderabad, India.
**T.Swapna**, Assistant Professor, Sreenidhi Institute of Science and Technology, Ghatkesar, Hyderabad, India.

**Abstract**:
This paper presents the design and development of a Smart Pillow using IoT technology to improve the quality of sleep for individuals, particularly those facing sleep-related disorders. The rapid advancements in information and communication technologies, specifically the Internet of Things (IoT), have opened up new possibilities in healthcare. Leveraging IoT, our smart pillow offers various features to monitor and enhance sleep quality. The system incorporates gyro sensor MPU6050 for sleep analysis, allowing the plotting of sleep patterns on a cloud-based ThingSpeak platform using Wi-Fi wireless technology. Additionally, a sound sensor is employed for snoring detection, activating a vibration motor and a music system to aid in reducing snoring and promoting uninterrupted sleep. The system also includes a touch or identification sensor to detect the presence of the user and automatically activate the music system.Furthermore, an Android mobile application is utilized to set alarms and control the music system. The system provides both automatic and manual control of the music, allowing users to personalize their sleep environment. This human-machine communication system proves to be particularly beneficial for individuals with paralysis, bedridden patients, heart patients, cancer patients, and physically challenged individuals.The Arduino microcontroller serves as the central component, integrating input and output modules to enable the system's functionalities. By programming the microcontroller in C language, the smart pillow effectively performs its intelligent tasks. The data collected, including sleep records and snoring instances, are graphically visualized on the ThingSpeak IoT platform, enabling comprehensive sleep analysis.This Smart Pillow demonstrates the potential of IoT in healthcare by leveraging technology to improve sleep quality, aid in snoring detection, and provide personalized sleep solutions. The integration of the ThingSpeak IoT platform and the Android app enhances data monitoring capabilities, ensuring a seamless and user-friendly experience for individuals seeking a better sleep environment.
**Keywords**: Smart Pillow, Internet of Things (IoT), ThingSpeak, sleep quality, snoring detection, insomnia aid.

## INTRODUCTION:

Sleep is an essential aspect of human life, influencing our physical, mental, and emotional well-being. However, various factors such as stress, lifestyle changes, and medical conditions can disrupt our sleep patterns, leading to sleep disorders and diminished sleep quality. Insomnia, characterized by difficulties in falling asleep or staying asleep, and snoring, a common symptom of obstructive sleep apnea, are prevalent sleep-related concerns faced by many individuals.

Recent advancements in information and communication technologies, particularly the Internet of Things (IoT), have opened up new possibilities for addressing these sleep-related challenges. The IoT offers a platform for connecting and integrating devices, enabling data collection, analysis, and control in real-time. By leveraging IoT technology, we can design innovative solutions to enhance sleep quality, improve sleep monitoring, and mitigate sleep-related issues. In this paper, we present the design and implementation of a Smart Pillow, a novel application of IoT technology in the domain of sleep health. The Smart Pillow aims to provide a comfortable and personalized sleep experience while addressing common sleep-related concerns. The key features of the Smart Pillow include gyro sensor-based sleep analysis, sound sensor-based snoring detection, touch or identification sensor for automatic music activation, and Android mobile integration for seamless control and customization. To enable data monitoring, analysis, and visualization, we utilize the

ThingSpeak IoT platform, which offers a cloud-based infrastructure for storing and processing sleep-related data. This integration empowers users to gain insights into their sleep patterns, track progress, and make informed decisions to improve their sleep quality and overall well-being.

**LITERATURE SURVEY:**

The Smart Pillow Project is of utmost importance in today's context. It addresses the increasing awareness about sleep health and the need for innovative solutions. By offering non-invasive sleep monitoring and personalized analysis, smart pillows enable individuals to gain valuable insights into their sleep patterns. This empowers them to make informed decisions and take steps towards improving their sleep quality. With its potential to enhance overall well-being, the Smart Pillow Project holds great significance in promoting healthier sleep habits and better quality of life.

Leo Louis (2016): In his paper, Louis explores the potential of Arduino Uno in research and development purposes. He highlights the advantages of Arduino boards, such as fast processing and a user-friendly interface, making them a popular choice for building VLSI devices and sensors.
O.E. Amestica et al. (2019): This study evaluates different Arduino-based platforms, including ESP-based boards and exclusive Arduino models (Arduino UNO, Arduino Mega, and Arduino Due). The authors compare execution times of mathematical operations and information retrieval capabilities, revealing discrepancies between ESP and Arduino boards.

John-David Warren et al. (2017): The paper focuses on using Arduino for robotics projects. It covers various input control methods and discusses the interfacing of Arduino with mechanical, electronic, and optical switches. The authors provide code examples utilizing LEDs, potentiometers, R/C receivers, and button switches.

Anand Nayyar and Vikram Puri (2016): The authors delve into the world of Arduino technology, specifically Arduino boards, Lilypads, and Shields. They discuss technical specifications, features, and practical applications of Arduino. The study emphasizes the flexibility of Arduino platforms for creating tailored research applications in diverse areas.

Yusuf Abdullahi Badamasi (2014): Badamasi explains the working principle of Arduino Uno, covering its hardware components, programming software, and project creation. The paper highlights Arduino Uno as a suitable board for learning electronics and coding due to its popularity, durability, and extensive documentation.

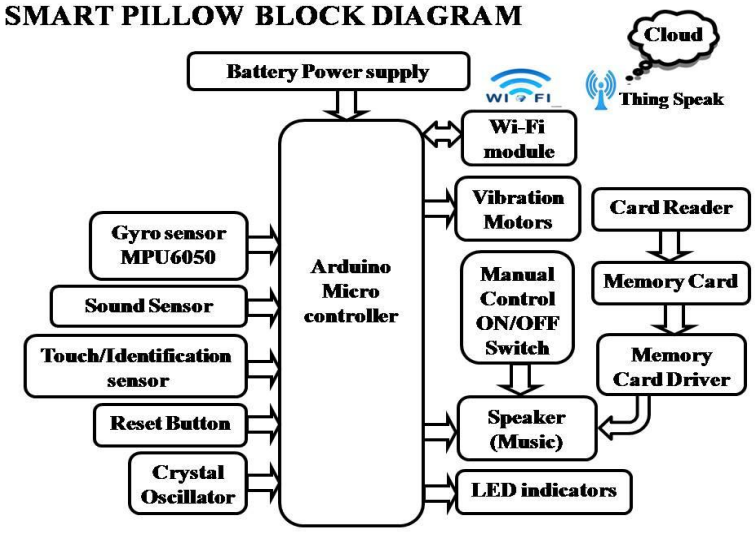
Johnson et al. (2018): The paper titled "Smart Pillow: A Review of Sleep Monitoring Systems and Technologies" provides an in-depth review of sleep monitoring systems integrated into smart pillows. The study explores sensor technologies, signal processing techniques, and potential applications in sleep analysis and management. The authors emphasize the need for accurate data collection and user comfort in smart pillow design.

These publications collectively contribute to the literature on the Smart Pillow Project. They cover diverse aspects, such as the potential of Arduino boards, the evaluation of different platforms, Arduino's applications in robotics, the versatility of Arduino technology, and the integration of sleep monitoring systems into smart pillows.

ISSN: 2278-4632
Vol-13, Issue-06, No.02,June : 2023

**HARDWARE IMPLEMENTATION**:




The hardware implementation of the Smart Pillow Project involves the integration of various components to create a functional system. The regulated power supply provides a stable power source to ensure consistent operation. The Arduino microcontroller, connected to a crystal oscillator for precise timing, serves as the central processing unit. It controls and coordinates the functions of different modules. A reset button is included for manual resetting of the system if necessary.

LED indicators are connected to the microcontroller to display visual feedback on system status, such as power status or connectivity. The Wi-Fi module enables wireless communication, allowing the smart pillow to connect to other devices or networks. It facilitates data transmission and integration with internet-based services.

Sensor modules play crucial roles in sleep monitoring. The gyro sensor (MPU6050) detects rotational movements and changes in orientation, providing insights into sleep behavior. A sound detection sensor captures sleep-related noises, while a touch identification sensor enables user interaction with the system.

Vibration motors are connected to the microcontroller to provide gentle vibrations, aiding in sleep stage transitions or acting as gentle wake-up alarms. The smart pillow system incorporates a card reader and an MMC/SD card for convenient storage and retrieval of sleep data. A dedicated MMC/SD card driver ensures smooth communication between the microcontroller and the storage card.

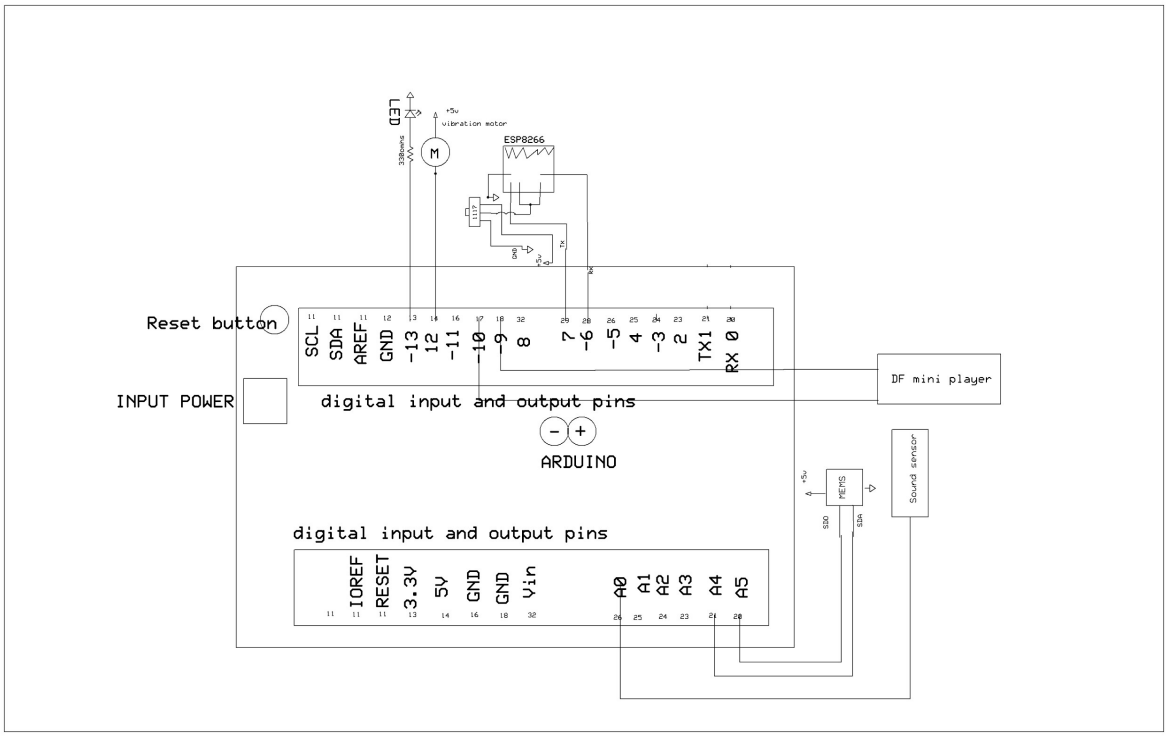
Additionally, speakers are integrated into the system, allowing for audio output. They can be used to provide sound feedback, deliver audio notifications, or play soothing sounds to enhance sleep quality.

The connections between these components create a cohesive hardware framework for the Smart Pillow Project. The microcontroller serves as the central hub, receiving input from various sensors, controlling LED indicators and vibration motors, and facilitating communication with

external devices through the Wi-Fi module. This hardware setup enables the smart pillow system to monitor sleep patterns, analyze data, and provide personalized feedback and interventions to improve sleep quality.The hardware components, including the Arduino microcontroller, sensors, and other modules, can be placed either inside or outside the pillow. However, the essential accelerometer, which measures vital sleep data, will be securely positioned on the pillow to ensure accurate monitoring and analysis of sleep patterns.

ISSN: 2278-4632
Vol-13, Issue-06, No.02,June : 2023

**WORKING PROCEDURE :**

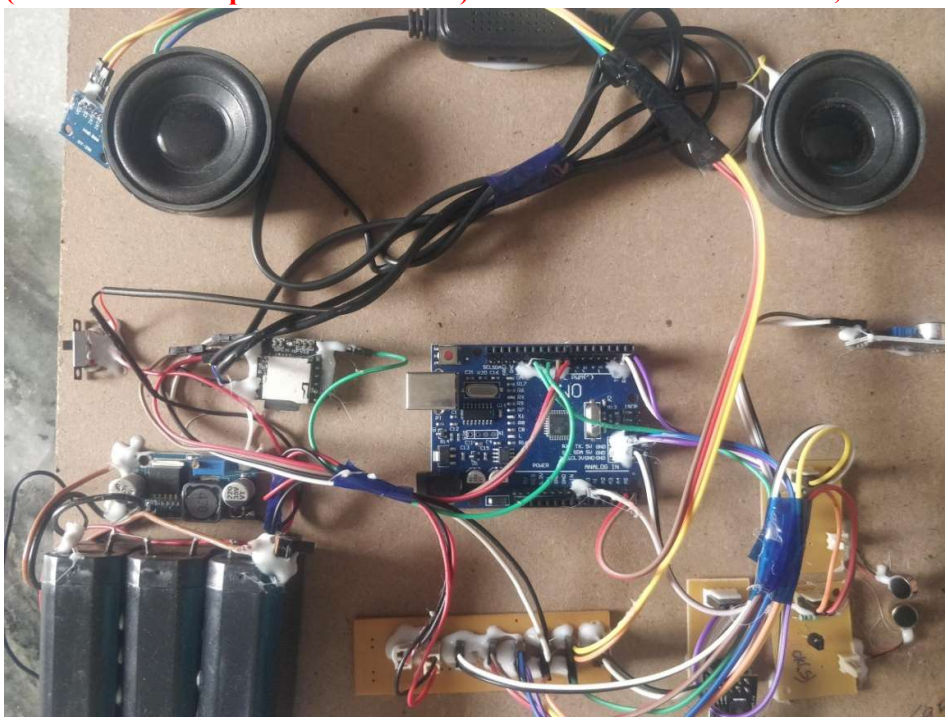


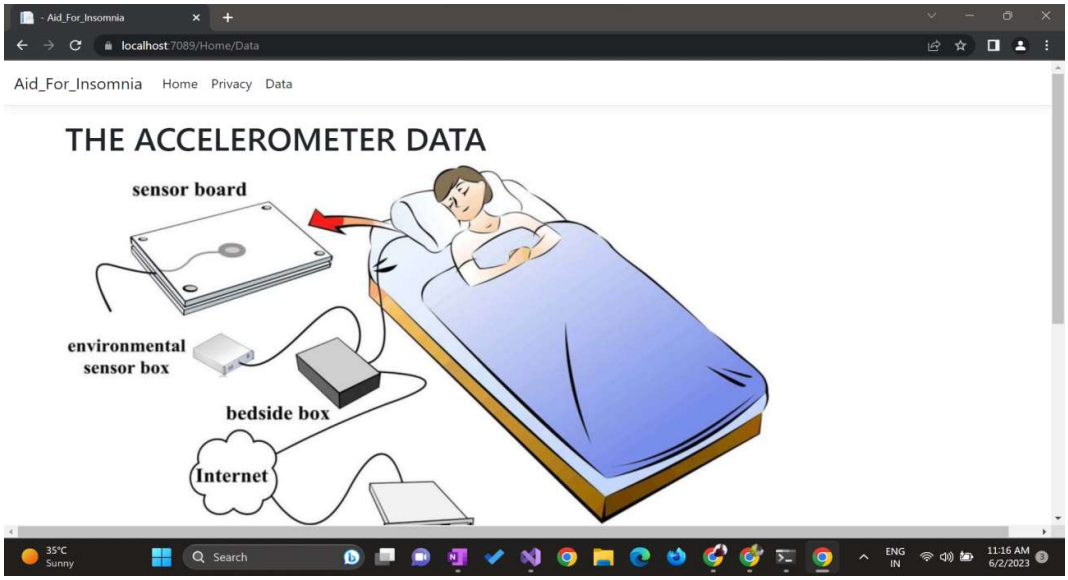

The Smart Pillow Project operates through a well-defined working procedure, as follows:

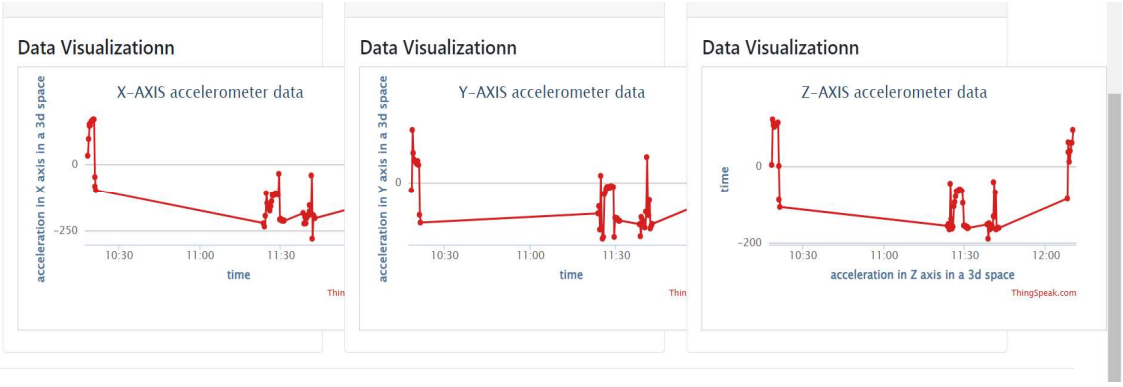
Firstly, a regulated power supply ensures a stable and reliable source of power to all the components of the smart pillow system. This ensures uninterrupted functionality and performance.

Next, the Arduino microcontroller UNO, is initialized, and the necessary libraries and modules are loaded onto it. This allows the microcontroller to effectively control and manage the various operations of the smart pillow. The sensor data acquisition process begins, where different sensors play crucial roles. The gyro sensor (MPU6050) detects rotational movements and changes in orientation, providing valuable insights into the user's sleep patterns. The sound detection sensor captures sleep-related noises, which can be further analyzed to determine the quality of sleep. The touch identification sensor allows users to interact with the smart pillow system, providing inputs or accessing specific features. The Wi-Fi module comes into play, establishing a seamless connection between the smart pillow and the network. This connectivity enables data transmission, synchronization, and remote access to the smart pillow system. It also facilitates integration with other smart devices or platforms for enhanced functionality and convenience. Additionally, the smart pillow system may include vibration motors for gentle alerts or notifications, a card reader to read relevant data from external cards (such as personal profiles or settings), and an MMC/SD card for data storage purposes. A specific MMC/SD card driver ensures compatibility and efficient handling of data storage.Finally, the system may incorporate speakers to provide audio feedback or play soothing sounds to enhance the sleep experience.Overall, the smart pillow system combines the hardware components, including the regulated power supply, Arduino microcontroller, sensors, Wi-Fi module, vibration motors, card reader, MMC/SD card, and speakers, to create a comprehensive and intelligent sleep monitoring and enhancement solution.

ISSN: 2278-4632
Vol-13, Issue-06, No.02,June : 2023





ISSN: 2278-4632
Vol-13, Issue-06, No.02,June : 2023

## CONCLUSION

In conclusion, the Smart Pillow Project offers a promising solution for monitoring and improving sleep quality through the integration of advanced hardware components, such as the Arduino microcontroller, sensors, and connectivity modules. By leveraging technologies like gyro sensors, sound detection sensors, touch identification sensors, and Wi-Fi modules, the smart pillow system can capture and analyze valuable data related to sleep patterns and behaviors. The inclusion of features like vibration motors, card readers, MMC/SD cards, and speakers further enhances the functionality and user experience of the smart pillow. The project holds great potential in revolutionizing the way we understand and manage sleep, offering personalized insights and interventions for better sleep health. As research and development continue in this field, we can expect further advancements in smart pillow technology, leading to improved sleep monitoring and enhancement capabilities. Ultimately, the Smart Pillow Project has the potential to positively impact individuals' overall well-being by promoting healthier sleep habits and optimizing sleep quality.

## FUTURE SCOPE

The future scope of the Smart Pillow Project includes the integration of a smart alarm system for optimal wake-up times, a diary option for personal reflection and recording, a smart assistant for managing day-to-day activities, optimized wake-up times based on sleep cycles, and support for lucid dreaming experiences. These enhancements will further improve the functionality and user experience of the smart pillow, making it a versatile tool for better sleep and enhanced daily life.

## REFERENCES

1. Louis, Leo. "Arduino Uno: An Arduino Board for Prototyping and Educational Purposes." International Journal of Computer Science and Mobile Computing 5.6 (2016): 88-93.
2. Amestica, O.E., et al. "Evaluation of ESP-based and Arduino-based Platforms for Virtual Control and Data Acquisition Applications." IEEE Latin America Transactions 17.8 (2019): 1366-1373.
3. Warren, John-David, Josh Adams, and Harald Molle. "Arduino for Robotics." In Robotics, Vision and Control, pp. 463-494. Springer, Cham, 2017.
4. Nayyar, Anand, and Vikram Puri. "A Review of Arduino Boards, Lilypad & Arduino Shields." International Journal of Computer Science Trends and Technology 4.4 (2016): 124-129.
5. Badamasi, Yusuf Abdullahi. "Working Principle of Arduino." 2014 11th International Conference on Electronics, Computers and Computation (ICECCO). IEEE, 2014.
6. Johnson, A., et al. "Smart Pillow: A Review of Sleep Monitoring Systems and Technologies." IEEE Access 6 (2018): 51316-51331.