De La Salle University
Computer Technology Department

NSEMBED
Mini Project #1

Section: s15 Group No.: 4 Date: _____

Names: Mendoza Adam | Santos Jose Grade: _____

1 Introduction

Passive-infrared (PIR) sensors are designed to recognize the presence of infrared light around a directed area. Typically, they are used in applications that want to detect motion, such as in automatic switches and security systems. For this project, you are tasked with developing an embedded system to be used for sleep monitoring. Using only a PIR sensor, an ESP32, and a computer, the system should record whenever the subject makes any significant movements throughout the sleep. You are expected to analyze the gathered results into presentable information.

2 Objectives

- General Objective:
  - To develop a system that is capable of recording movement for sleep monitoring.
- Specific Objectives:
  - To understand the specifications and requirements of the PIR sensor;
  - To interface the PIR sensor to an ESP32;
  - To establish communication between the ESP32 and computer;
  - To timestamp the movements with actual time and day; and
  - To test and verify the system with actual sleeping scenarios.

3 Scope and Limitations (Requirements)

For reference, the PIR sensor that will be given to you has a part number of HC-SR501. You are meant to do a brief study of the sensor to figure out how it is used, how it connects to a microcontroller, and how to tune it to fit in a specific environment. This study should be documented in the "PIR Sensor" chapter of the report.

The sensor should be interfaced to the ESP32 board. When the sensor detects movement, the built-in LED of the ESP32 should turn on. Then when movement is no longed detected, the built-in LED of the ESP should turn back off. The ESP32 should be connected to the computer, so that it can send movement activities via serial communication. The computer should be able to store the data and make sure that activities are referenced with actual time for further analysis.

The system should first be tested with simulated actions to make sure that is functioning in the first place. Test procedures and results from this part should also be included in the documentation. Then, the system should be tested with actual sleeping subjects (no simulation). Several tests should be conducted to collect results which should be presented using tables, graphs,

and charts, with descriptions that explains and analyzes the results. You are expected to document the entire process of the project by referring to the succeeding parts of this document for guidance.

4 PIR Sensor

Include a short technical discussion of the sensor, such as how it works, what are the different configurations in hardware and software, what are the pin descriptions, etc.

5 System Overview

In diagrams, flowcharts, short descriptions, and photos, explain how your system works (hardware and software) and how the test environment and methodology is set up.

6 Results and Analysis

Share the results gathered from the experiment using tables, graphs, and charts. Do not just show raw data. Include short descriptions that explains and analyzes the results.

7 Conclusion

Include a short conclusion that reviews the introduction and objectives.

References

Include references, if any.

Rubric:

Embedded System - Specifications	The developed system is successfully able to complete all the required specifications. 30	The developed system is successfully able to complete most of the required specifications, only missing out on one or two minor features. 29 – 25	The developed system is successfully able to complete some of the required specifications, missing out on one major feature or on more than three minor features. 24 – 20	The developed system is successfully able to complete a few of the required specifications, missing out on two or more major features and on more than three minor features. 19 – 1	The developed system is not able to successfully complete any requirement. 0
Embedded System – Test and Verification Procedures	Several test procedures, which are relevant and appropriate to the objectives, are conducted. 15 - 11	Only a few test procedures, which are relevant and appropriate to the objectives, are conducted. 10 - 6	Only a few test procedures were conducted, but none of which are relevant and appropriate to the objectives. 5 - 1	No test procedures were conducted. 0	
Documentation – PIR Sensor	The discussion of the sensor is short, but concise, and completely covers the necessary features that are applied in this project. 5 - 4	The discussion of the sensor is short, but concise, and covers some of the necessary features that are applied in this project. 3 - 1	No discussion of the sensor is included. 0		
Documentation – System Overview	The discussion includes all the hardware, software, and testing methods that	The discussions include some of the hardware, software, and testing	The discussions include only a few of the hardware, software, and	No system overview is included. 0	

	were conducted. It is supported by several diagrams, flowcharts, and photos. 15-11	methods that were conducted. It is supported by only one or two supporting diagrams, flowcharts, and photos. 10-6	testing methods that were conducted. It is not supported by diagrams, flowcharts, and photos. 5-1		
Documentation – Results and Analysis	The results are presented using a variety of tables, charts, and graphs, which are companied by short descriptions. Analysis of results are included relevant. 10 - 8	The results are presented using only a single table, chart, or graph, which is companied by short descriptions. Analysis of results are included but is not very relevant. 7 - 5	The results are presented using only a single table, chart, or graph, which is companied by short descriptions. No analysis to the results is provided. 4 - 2	Raw data is presented, and no analysis is included. 1 - 0	
Documentation - Conclusion	The conclusion is well-written. 5 - 4	The conclusion misses out of particular pieces of information or details. It is not very well-written. 3 - 1	No conclusion is included. 0		

Rubric:

Understanding the PIR Sensor (based on the documentation) 5

Embedded system technical specifications (based on hardware and software) 30

Embedded System 35 pts

Embedded System – Specifications 30

Embedded System – Testing Procedures 15

Documentation 35 pts

Documentation – PIR sensor 5

Documentation – System Overview 15

Documentation – Results and Analysis 10

Documentation – Conclusion 5