S.A.S.S (Sensor Assisted Supervision System)

A Project Report submitted to Department of
Biomedical Engineering in partial fulfilment of the laboratory course
Microcontroller Lab (BME 3261)

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ABSTRACT

1] Introduction

Patients suffering from Alzheimer or aged individuals are often in need of supervision to proceed with their day to day activities. These require a constant presence of staff or caretakers. If left unsupervised accidents may occur due to dementia.
According to research containing data from 2000 to 2013, the injuries caused due to dementia are suffocation, accidental drug poisoning. However the most number of injuries were from traffic accidents and falls.

The intent behind the Sensor Assisted Supervision System is to set up an environment that allows the staff to react immediately when the patients move around outside the normal routine.

2] Methodology

To achieve a result which aims at increasing the effectiveness of patient monitoring, a system where the staff are alerted despite them not being present in case of patients moving outside of the stipulated time is required.
SASS (sensor assisted supervision system) is designed to aid in providing a monitoring system where staff do not need to be actively watching over the patients.

3] Result

When the subject moves, the socks embedded with the pressure sensor starts sending a signal to the alerting mechanism wirelessly. The staff notices the alert and immediately goes to assist the subject. This prevents untimely accidents that would have been caused due to lack of such monitoring systems.

Keywords:
Alerting, monitoring, sensing, trans-receiver, Arduino , nRF24L01,

CONTENT TABLE

CHAPTER-1

INTRODUCTION

Patients suffering from Alzheimer or aged individuals are often in need of supervision to proceed with their day to day activities. These require a constant presence of staff or caretakers. If left unsupervised accidents may occur due to dementia.
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MOTIVATION

- Overall, 5.5m people suffer from Alzheimer and 34% of toileting-related falls occur during the night.
- Currently, there are more than 47 million Alzheimer's patients globally, and by 2050, that figure is projected to increase to 131 million.
- As lifestyles continue to change, injury has emerged as a global public health issue and a primary cause of mortality. Injuries can also result in serious trauma and long-term disabilities.
- Our motivation is to reduce the pressure on The staff assigned to watch over Alzheimer patients .

PROBLEM STATEMENT

Design a product that can effectively help in monitoring aged patients and patients afflicted with Alzheimer. It should make sure it doesn't cause discomfort to the patients and maintain privacy.

ORGANIZATION OF THE REPORT

In the following chapters we will discuss about:

- **CHAPTER 2 :** In this chapter we will discuss about the Methodology, idea and inspiration behind the project

- **CHPATER 3:** in this chapter we will discuss about the pin configurations and working of Arduino and nrf in brief

- **CHAPTER 4:** in this chapter we present both the receiver and transmitter codes and the flow charts.

- **CHAPTER 5:** in this chapter we discuss about the working principle

- **CHAPTER 6:** in this chapter we will discuss about the final result, future scope an the drawbacks

CHAPTER 2

METHODOLOGY

- The aim is to create a sensor that activates on movement of the patient.

- To approach a suitable solution, the necessary aspects were a sensor for movement and an alarm working in series to stimulate an alerting system.

- In the United States of America individuals that are under house arrest are given an ankle monitor by the law enforcement. When the individuals are within the bounds allowed, the ankle monitors do not activate. However as soon as they leave the designated region the monitors send a signal to the law enforcers of a possible escape attempt.

- This system inspires a possible monitoring system that can help in reducing the pressure on the staff or caretakers from constantly monitoring patients with Alzheimer.

- To sense movement pressure sensors were selected to be placed under the foot. The intended outcome was that as the patient moves the pressure is applied under the foot and is picked up by the sensor.

- The Arduino connected to the pressure sensor sends a wireless signal to the other end which receives the signal.

- The receiving Arduino is connected to either a light or buzzer.

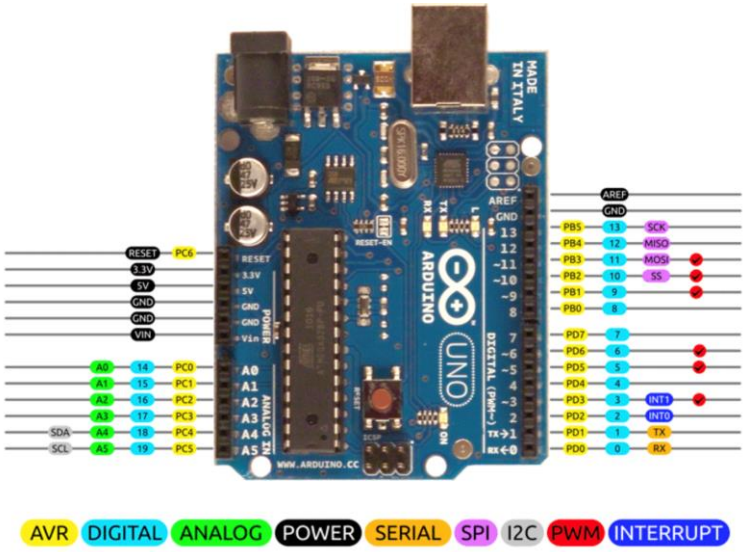
- When the Arduino receives the signal it activates the buzzer or light which immediately gets the attention of nearby staff or caretaker.

CHAPTER 3

HARDWARE

BASICS OF AURDINO UNO

The popular Arduino Uno microcontroller development board is built around the 8-bit ATmega328P processor. It also has additional components to help the microcontroller, such as a voltage regulator, serial connectivity, and crystal oscillator, in addition to the ATmega328P MCU IC.



POWER

- Vin: When using an external power source, Vin is the voltage input to the Arduino.
- 3.3V: The voltage regulator on board produces a 3.3V supply. 50mA is the maximum current draw.
- 5V: Microcontroller and other components on the board are powered by a regulated 5V power source.

INTERRUPTS

- Pins 2 and 3 are used to connect external interrupts.

ANALOG PINS

- Pins A0 to A5 are used for interfacing analog devices who's input signals are in the range of 0 to 5 Volts

DIGITAL PINS

- Pins 0 to 13 are used to interface digital inputs and receive digital outputs

SERIAL COMMUNICATION PINS

- Pins 0(Rx) and 1(Tx) are used to receive TTL (transistor-transistor logic) serial data

PWM PIN

- Pins 3,5,6 and 11 Provides a pulse width modulated output

SPI PIN

- Pins 10,11,12 and 13 are Used to connect serial peripheral interface devices that help in synchronous communication

TWI PIN

- Pins A4, A5 are used to interface unique two-wire bus devices with One clock line and one data line make.

AREF

- The AREF pin is used to provide reference voltage for input voltage.

GND

- Ground pins.

STORGAE OPTIONS

- Arduino-uno houses 2KB of SRAM, 32KB of Flash Memory (bootloader) and 1KB of EEPROM

GENEARL SPECIFICATIONS

- Arduino-uno Has a clock speed of 16 MHz
- DC Current on I/O Pins: 40 mA
- DC Current on 3.3V Pin: 50 mA

BASICS nRF24L-01 Module

As a wireless transceiver module, the nRF24L01 may send and receive data from other modules.

PIN FUNCTION

Pin	Name	Pin function	Description
1	CE	Digital Input	Chip Enable Activates RX or TX mode
2	CSN	Digital Input	SPI Chip Select
3	SCK	Digital Input	SPI Clock
4	MOSI	Digital Input	SPI Slave Data Input
5	MISO	Digital Output	SPI Slave Data Output, with tri-state option
6	IRQ	Digital Output	Maskable interrupt pin. Active low
7	VDD	Power	Power Supply (+1.9V - +3.6V DC)
8	VSS	Power	Ground (0V)
9	XC2	Analog Output	Crystal Pin 2
10	XC1	Analog Input	Crystal Pin 1
11	VDD_PA	Power Output	Power Supply Output (+1.8V) for the internal nRF24L01+ Power Amplifier. Must be connected to ANT1 and ANT2 as shown in Figure 29.
12	ANT1	RF	Antenna interface 1
13	ANT2	RF	Antenna interface 2
14	VSS	Power	Ground (0V)
15	VDD	Power	Power Supply (+1.9V - +3.6V DC)
16	IREF	Analog Input	Reference current. Connect a 22kΩ resistor to ground. See Figure 29.
17	VSS	Power	Ground (0V)
18	VDD	Power	Power Supply (+1.9V - +3.6V DC)
19	DVDD	Power Output	Internal digital supply output for de-coupling purposes. See Figure 29.
20	VSS	Power	Ground (0V)

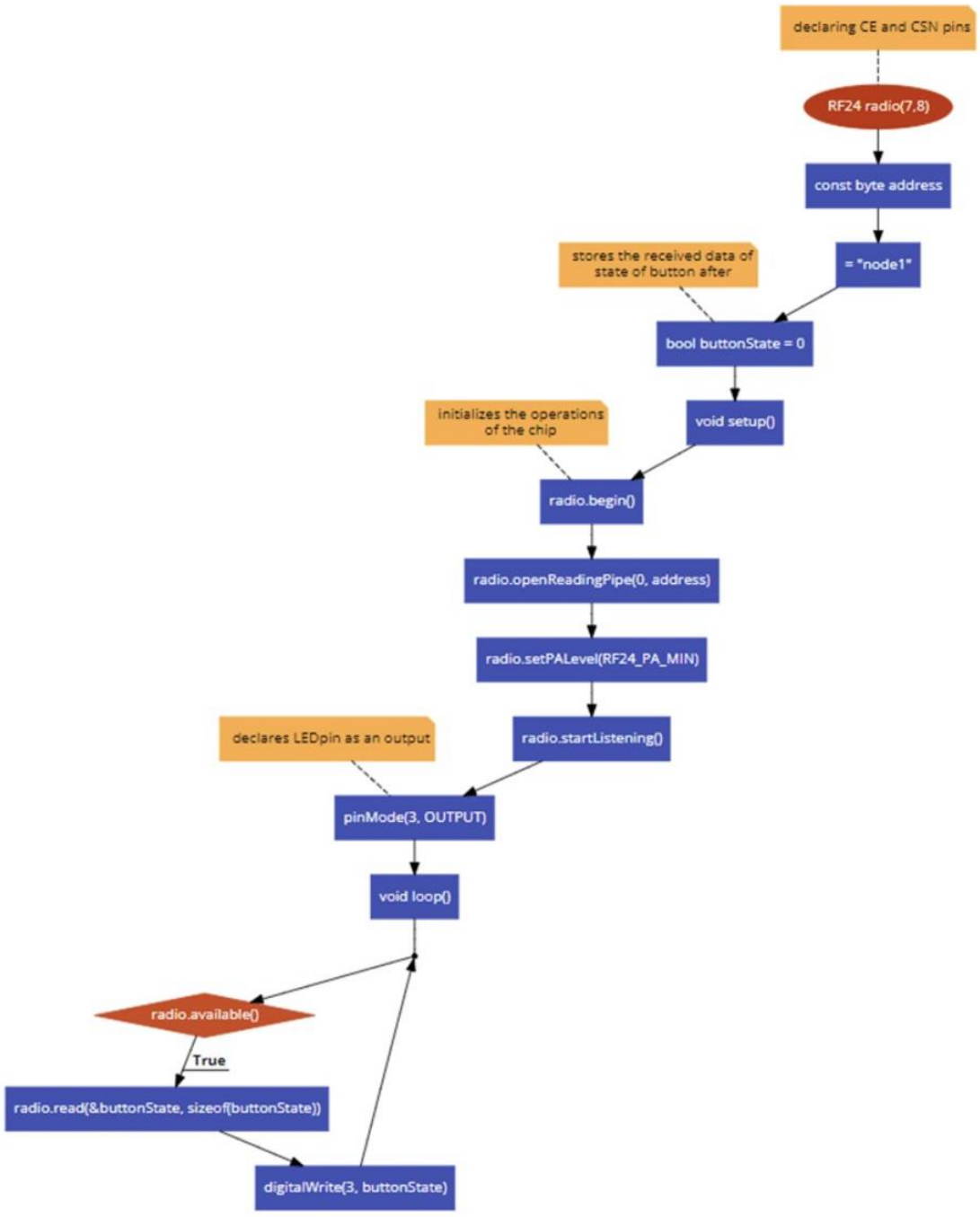
CHAPTER 4

SOFTWARE

RECEIVER CODE:

```
#include <SPI.h>
#include <RF24.h>
#include <nRF24L01.h>
RF24 radio(7,8); // declaring CE and CSN pins
const byte address[] = "node1";
bool buttonState = 0; // stores the received data of state of button after
void setup() {
  radio.begin(); // initializes the operations of the chip
  radio.openReadingPipe(0, address);
  radio.setPALevel(RF24_PA_MIN);
  radio.startListening();
  pinMode(3, OUTPUT); // declares LEDpin as an output
}
void loop() {
  while(radio.available())
{
        radio.read(&buttonState, sizeof(buttonState));
        digitalWrite(3, buttonState);
  }
```

}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RF24 radio(7,8)
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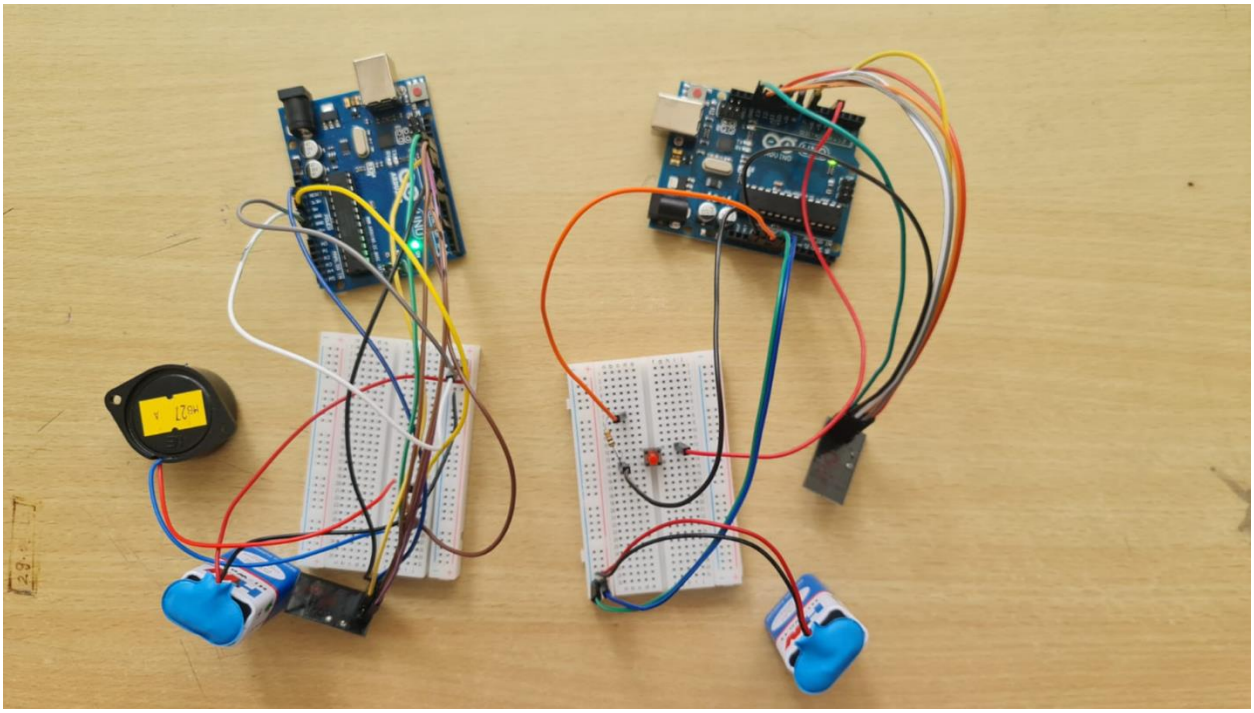
stores the received data of state of button after
bool buttonState = 0
initializes the operations of the chip
void setup()
radio.begin()
radio.openReadingPipe(0, address)
radio.setPALevel(RF24_PA_MIN)
declares LEDpin as an output
radio.startListening()
pinMode(3, OUTPUT)
void loop()
radio.available()
True
radio.read(&buttonState, sizeof(buttonState))
digitalWrite(3, buttonState)

TRANSMITTER CODE:

```
#include <SPI.h>
#include <RF24.h>
#include <nRF24L01.h>
RF24 radio(7,8);   // declaring CE and CSN pins
const byte address[] = "node1";
bool buttonCheck = 0;  // the value returned by digitalRead(4) is stored here
void setup() {
  radio.begin();  // initializes the operations of the chip
  radio.openWritingPipe(address);
  radio.setPALevel(RF24_PA_MIN);
  radio.stopListening();
  pinMode(4, INPUT); // declares pushButton as an input
}
void loop() {
  buttonCheck = digitalRead(4);
  radio.write(&buttonCheck, sizeof(buttonCheck));
}
```

CHAPTER 5

WORKING PRINCIPLE



- Motion altering system consists of five piezoelectric transducers which send a signal to the microprocessor when a change in pressure is sensed.
- The microprocessor then transmits data in the form of radio waves(2.4 Ghz-2.525Ghz) with help of a transceiver.
- The second transceiver on the other end receives the data and activates the alerting unit with the help of a microprocessor.

CHAPTER 6

DRAWBACKS AND FUTURE SCOPE

DRAWBACKS

1] our present version of the project makes use of Arduino-uno Microcontroller and nRF24L01 which are bulky. It causes discomfort to the patients.

2] Our version of the project contains circuitry which cannot come in contact with water.

3] The expenditure behind the production of one unit is not market friendly.

FUTURE SCOPE

1] Both components can be incorporated into a PCB to attain a minimalistic design. The smaller size of the PCB helps in reducing the discomfort caused by bulk and making it user friendly

2] Future version of our model can be developed to be water resistant.

3] use of PCB instead of Arduino will drastically reduce the cost, making it easier for mass production

REFERENCES

1] https://alzres.biomedcentral.com/articles/10.1186/s13195-018-0437-0 - (Introduction)

2] https://alzres.biomedcentral.com/articles/10.1186/s13195-018-0437-0 - (Introduction)

3] https://www.youtube.com/watch?v=UoeU79G09Dk - (Hardware)

4] https://www.youtube.com/watch?v=rNFnxSiAeAo&t=10s - (Software)

5]https://www.sparkfun.com/datasheets/Components/SMD/nRF24L01Pluss_Preliminary_Product_Specification_v1_0.pdf - (nRF24L01 Module)

6] http://www.hobbyandyou.com/rees52-nrf24l01-24ghz-wireless-transceiver-module-for-arduino -

(nRF24L01 Module)

7] https://components101.com/microcontrollers/arduino-uno - (Arduino-uno)

PLAGRISM CHECK (RESULT)