Software Requirement Specification Document for Running Alarm

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Table 1: Document version history

Version	Date	Reason for Change
1.0	25-Oct-2020	SRS First version's specifications are defined.

GitHub: https://github.com/seif-92/Running-Alarm-Robot

Contents

Abstract

A lot of people suffer from waking up on time and even if they did they spend much time in bed without getting up and alarms can't solve this problem, so we thought of something that does, the proposed project is basically an alarm on wheels that forces the user to get up of his bed and run after it to shut it down. Using Ultrasonic sensors the alarm will avoid collision while moving, also the addition of other sensors like gas leak and fire detectors that will be connected to the user's phone using our mobile application elevates the importance and the usage of this device. The mobile application will be used to receive alerts in case of fire or gas leak, monitor the house through the camera built in the alarm and even control the movement of the alarm. The robot also will have the ability to recognise and identify it's through face recognition machine learning model.

1 Introduction

1.1 Purpose of this document

The motive of this document is to demonstrate a detailed documentation of our Running Alarm Robot project and highlight the main points and the progress of this project.

1.2 Scope of this document

This document discusses the similar systems to our project, addresses our first part of working hardware, explains the functional and non-functional requirements and design constraints.

1.3 Business Context

Most people use alarms to wake up and offering a device that forces people to change a behaviour they want change but are not able to will have a great effect at a huge market, it will used at home specifically in bedroom to help users wake up easier. Every home , every house every apartment have a traditional alarm and the RAR(Running Alarm Robot) is the key to solve a very common problem.

2 Similar Systems

2.1 Academic

- This paper[1] is about implementation of mobile robot remote fire alarm system, which consists of a mobile robot and a remote terminal.the mobile robot's and remote terminal's processor is the STC89C52, and the detecting system is made up of a combination of photoelectric sensors, infrared sensors, and other sensors. The software system creates and employs several algorithms, including those for wireless communication, robot line-tracking, and fire detection. there is no diversity in the features, as their project is distinguished by the fact that it will detect heat and does not have a smart moving alarm feature or gas detection .finally it results detection range can be up to 2.3m with a high accuracy.there is lack in data

set.

- This paper[2] is about offering a model for automated gas pipeline tracking.in order to accomplish the robot they used the Arduino microprocessor equipped with gas sensor MQ2, LED and buzzer alarm for alert people and data logger in microSD memory card. there is no diversity in the special because their concept stands out because it will detect gas but lacks a clever moving alarm or fire detection capability.. According to test results, a wheeled robot with the ability to detect the presence of flammable gas followed a gas pipeline using the line follower concept, discovered the leakage point, and stopped right away at a distance of 5.87 cm from the leakage point.there is lack in data set.

- This pape[3] is about implementation a very friendly, helpful and considerate morning companion-robot clock, but also a very persuasive one! It uses multiple methods to effectively wake you up (light, sounds and movements). Our robot's primary processor is the Raspberry Pi. In Linux, the cron daemon is used to carry out the alarm clock's scheduled activities. The robot's eyes and the time display are both on an LCD screen. The robot has loudspeakers built into its ears that allow it to "talk" and play music. At a predetermined moment, an ultrasonic atomizer in an aroma diffuser is activated to discharge aroma. Robot mobility is made possible by an engine-driven set of wheels and infrared sensors, allowing the machine to manoeuvre and avoid obstacles.there is lack in data set.there is no diversity in the features, as it does not have a fire detection or leaking gas detection that keeps the person safe while he is asleep.

2.2 Business Applications

[4] Clocky is a running alarm robot that has some similar main functions with our project, they managed to create a robot that runs around the house until the user turns it off. Clocky was created by Gauri Nanda in 2005, while she was a student at the Massachusetts Institute of Technology.

3 System Description

3.1 Problem Statement

Many people face problems waking up whether it's because of messing up their sleep routine or because of a certain disease that makes them a lot more lazy, they fight their bodies to get up from bed and they eventually lose this fight most of the time. This problem affects many aspects of their life mainly educational and physical parts.

3.2 System Overview

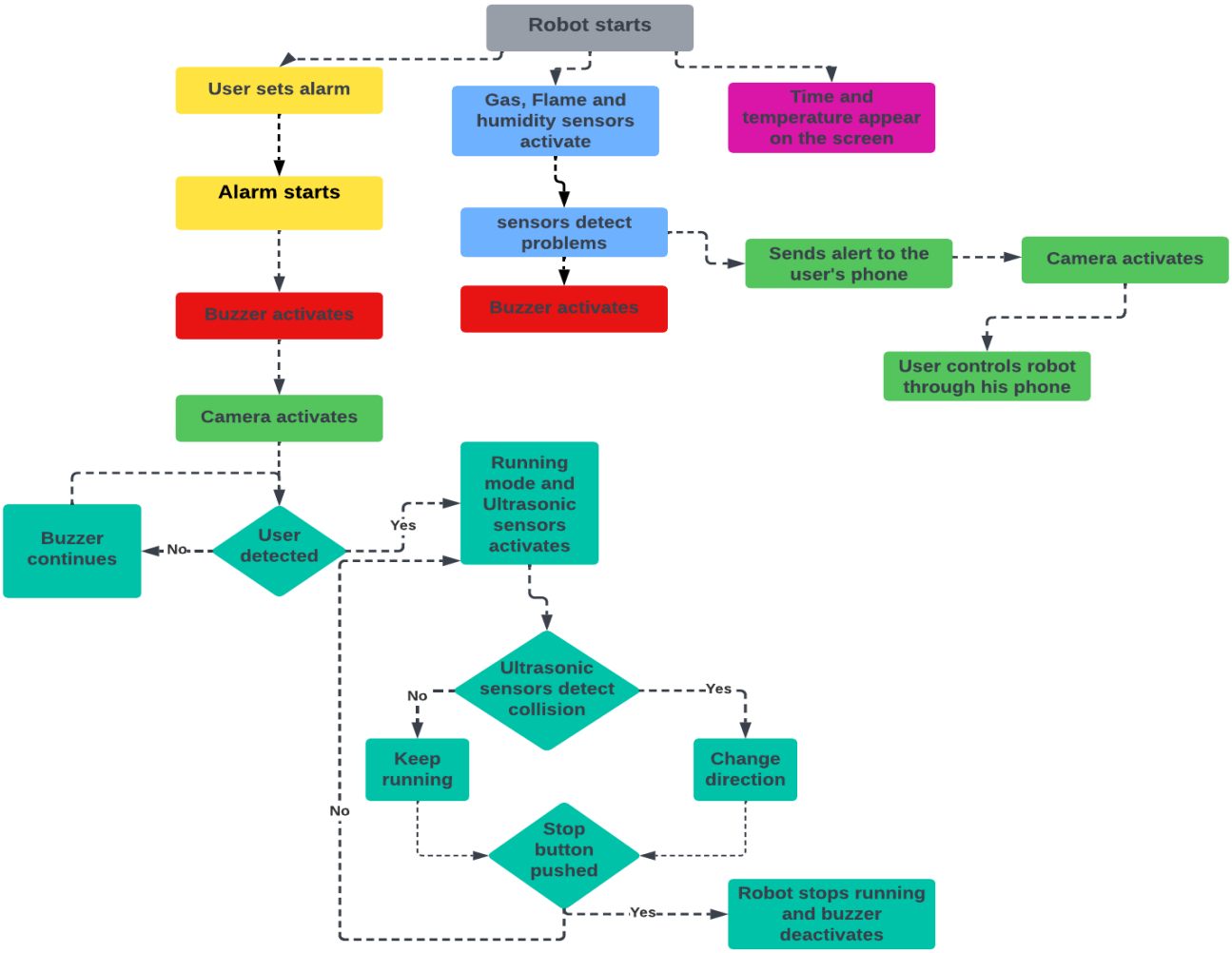


Figure 1: System Overview

3.3 System Scope

The project aims to achieve an accurate robotic alarm system to move freely and avoid collision, also a mobile application connected to the alarm to monitor the house through it and receive alerts from fire and gas sensors built in our robot. Through the camera built in the robot and machine learning models, the robot will have the ability to detect the human body and recognise it's owner through face recognition.

3.4 System Context

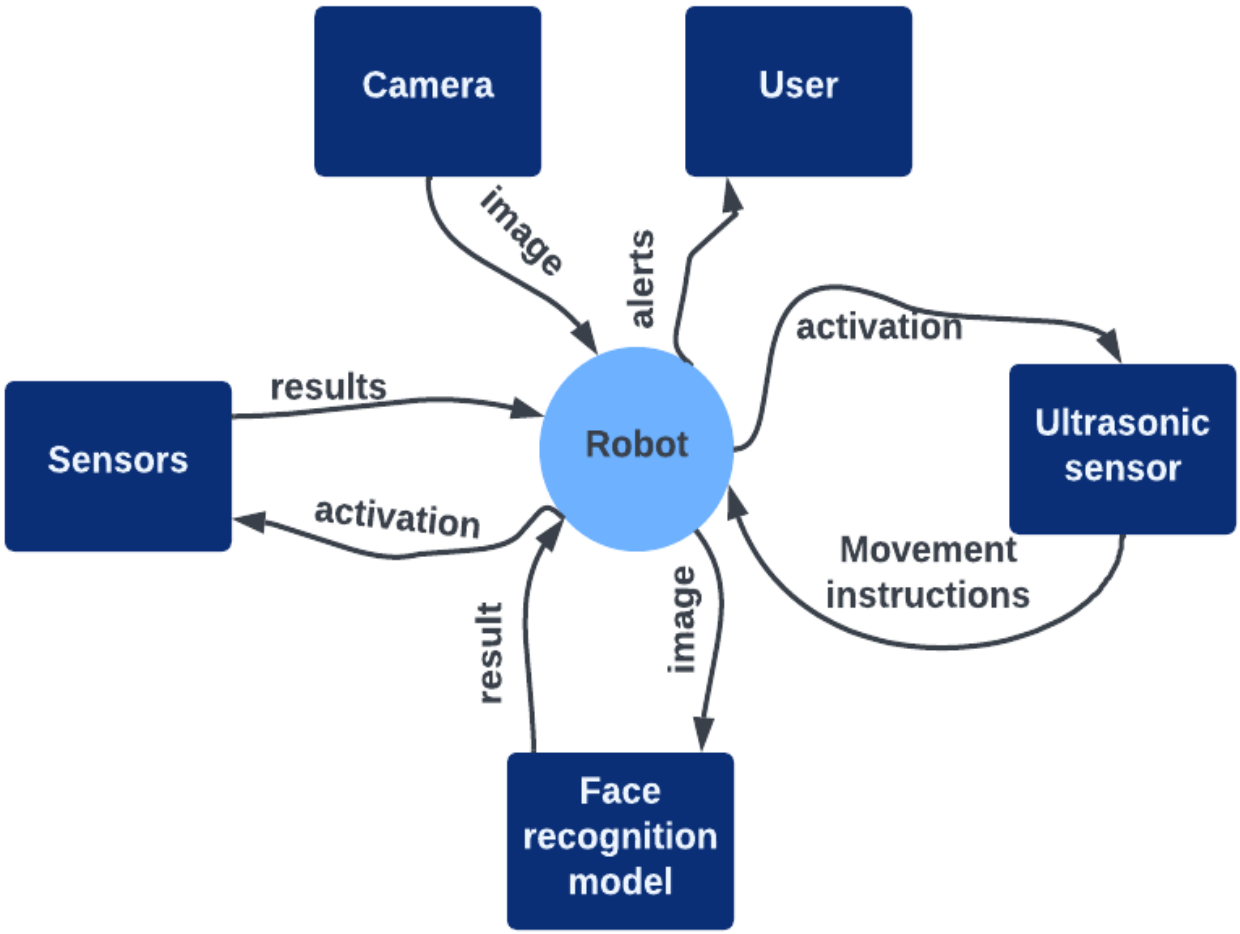


Figure 2: context diagram

3.5 Objectives

- To apply sensors for the robot to move safely in the house avoiding collision.
- To build a durable body that doesn't get affected by falling down from certain heights.
- To install sensors for fire detection and gas leaks, camera , loud speaker and lcd screen.
- To find a solution for the ultrasonic angle issue.
- To develop a mobile application to control the alarm robot remotely and receive alerts.
- To achieve not less that 90% accuracy on our face recognition machine learning model.
- To apply a security system to maintain the user's privacy.

3.6 User Characteristics

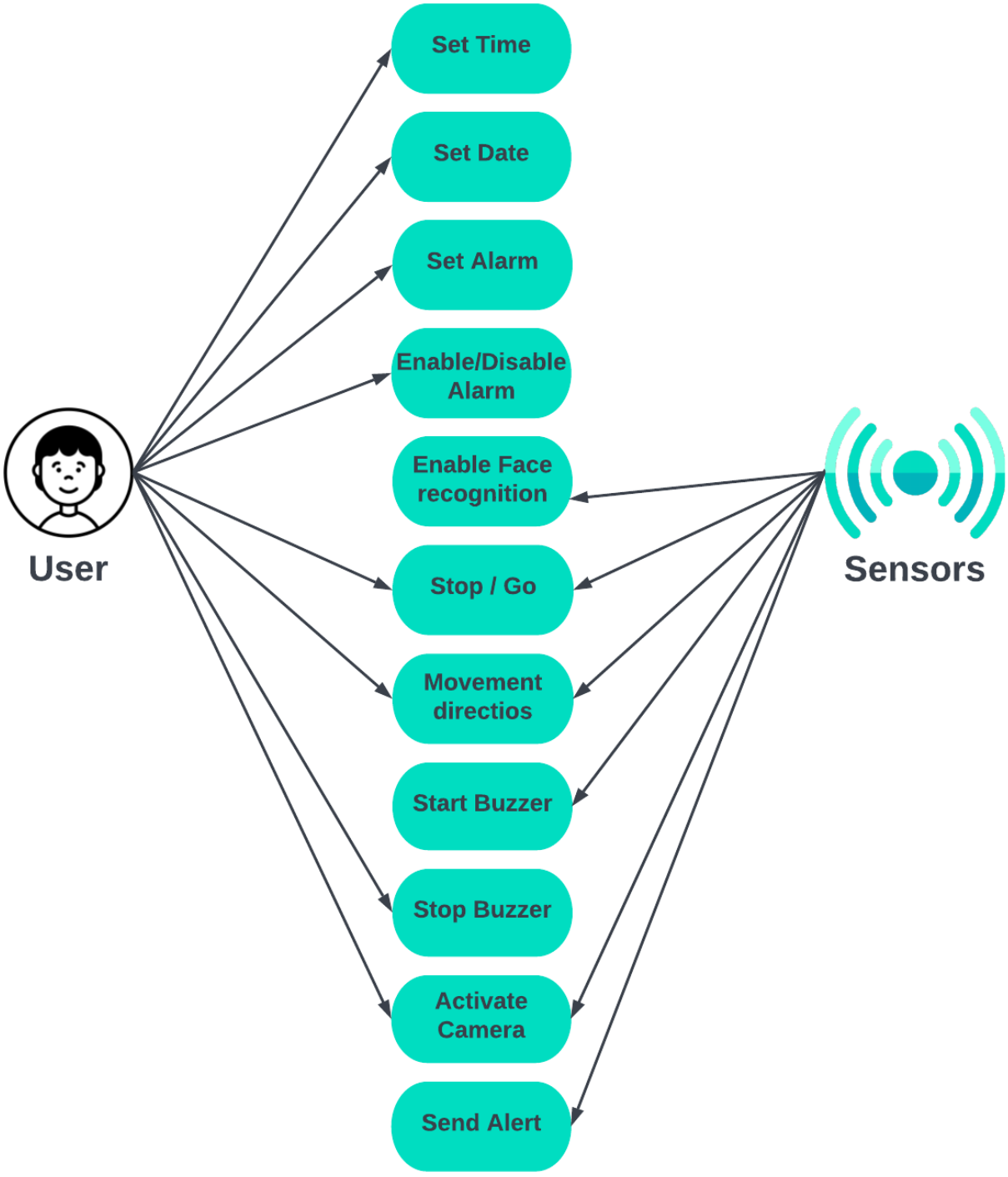
- The user must have a basic understanding of how to use a mobile phone.
- The user can be of any age.

4 Functional Requirements

4.1 System Functions

- **ID01**: The user shall be able set the date and the time.
- **ID02**: The user shall be able to enable the alarm and set it.
- **ID03**: The macheine learning model shall be able to detect and recognise the owner.
- **ID04**: The robot will start running or stay in place according to the user's state.
- **ID05**:The Ultrasonic sensor will give the robot movement instructions.
- **ID06**:The alarm and the sensors will be able to start the buzzer.
- **ID07**:The user and the sensor shall activate the camera whenever they need.
- **ID08**: The user shall be able to control the movement of the robot through his phone.

The following figure represents the Use Case diagram



Use Case Diagram

Name	obstacle detection
Code	ID
Priority	Extreme
Critical	The robot detects if something is in its way
Description	The Ultrasonic sensor will detect the obstacles and give instrauctions to the robot
Input	obstacle detected via ultrasonic sensor .
Output	The robot modify its route.
Pre-condition	There must be an obstacle to be detected.
Post-condition	The robot will stop then change its way.
Dependency	Detect obstacles.
Risk	The robot collides with the obstacle.

Name	Face recognition
Code	ID03
Priority	Extreme
Critical	The Model must be trained well to ensure the result are as much accurate possible .
Description	Using our ML algorithm the robot shall be able to recognise and detect it's owner.
Input	images through the camera
Output	deciding whether it's the owner or not
Pre-condition	The camera must be activated on this dataset.
Post-condition	the user will will be notified if another person is detected
Dependency	The user has to get closer to the robot
Risk	The model could fail in detecting it's owner.

Name	buzzer
Code	Id06
Priority	Extreme
Critical	The alarm and sensors shall be able to activate the buzzer
Description	The alarm will activate the buzzer when it rings and the sensors if they detect any fire or gas leak
Input	boolean result from the sensor and the alarm
Output	buzzer activates
Pre-condition	There must be a problem detected by the sensors or the it's time for the alarm to ring
Post-condition	the buzzer won't be deactivated except through the user
Dependency	-
Risk	The buzzer won't activate.

5 Design Constraints

5.1 Standards Compliance

- UL60950 - Safety of Information Technology Equipment: Any products classified as information technology must adhere to this standard.
- AS3100 - Approval and test specification - General requirements for electrical equipment: This is the primary specification governing the approval and test specification of electrical equipment. As such any electronic product must adhere to these basic rules governing safety.

5.2 Hardware Limitations

- H-bridge : They are functioning at 1/2 the supply potential where the switching transistors are operational two times. the collector current as in comparison with the basic push-pull scheme. It is not suitable for current mode control.
- Micro-controller : Cannot interface a better power device directly. Number of executions is limited. It is generally utilized in micro equipment.
- DC-Motor : Its Cogging at speeds of less than 300 rpm. Significant power loss on full wave rectified voltage.
- Gas sensor : It is difficult to know failure modes unless very advanced methods of monitoring are used.
- Humidity sensor : It is sensitive to dewing and certain aggressive substances. It is difficult to use below temperature of 0oC and with lower humidities.
- Ultrasonic sensor : It is very sensitive to variation in the temperature. It has more difficulties in reading reflections from soft, curved, thin and small objects.

- Servo motor : Complex controller requires encoder and electronic support. Peak torque is limited to a 1 percent duty cycle. Servo Motors can be damaged by sustained overload. Gear boxes are often required to deliver power at higher speeds.
- LCD screen : In high-temperature environments, there is a loss of contrast. it requires an additional light source.

6 Non-functional Requirements

6.1 Reliability

The robot should be aware of specified users and surroundings obstacles.

6.2 Safety

The system shall detect the harm that could occur because of the sensed gas and fire and notify user about any outsiders.

6.3 Availability

- The sensors should be connected correctly onto the micro-controller to avoid any bugs that could happen.
- The sensors should not be covered to work properly.

6.4 Performance and Response Time

The robot detect an obstacle within 15 cm then stops and reroute itself and check for any surroundings obstacles every 0.25 second .

6.5 Portability

As this system is developed mainly as a hardware device that will be coded in python.

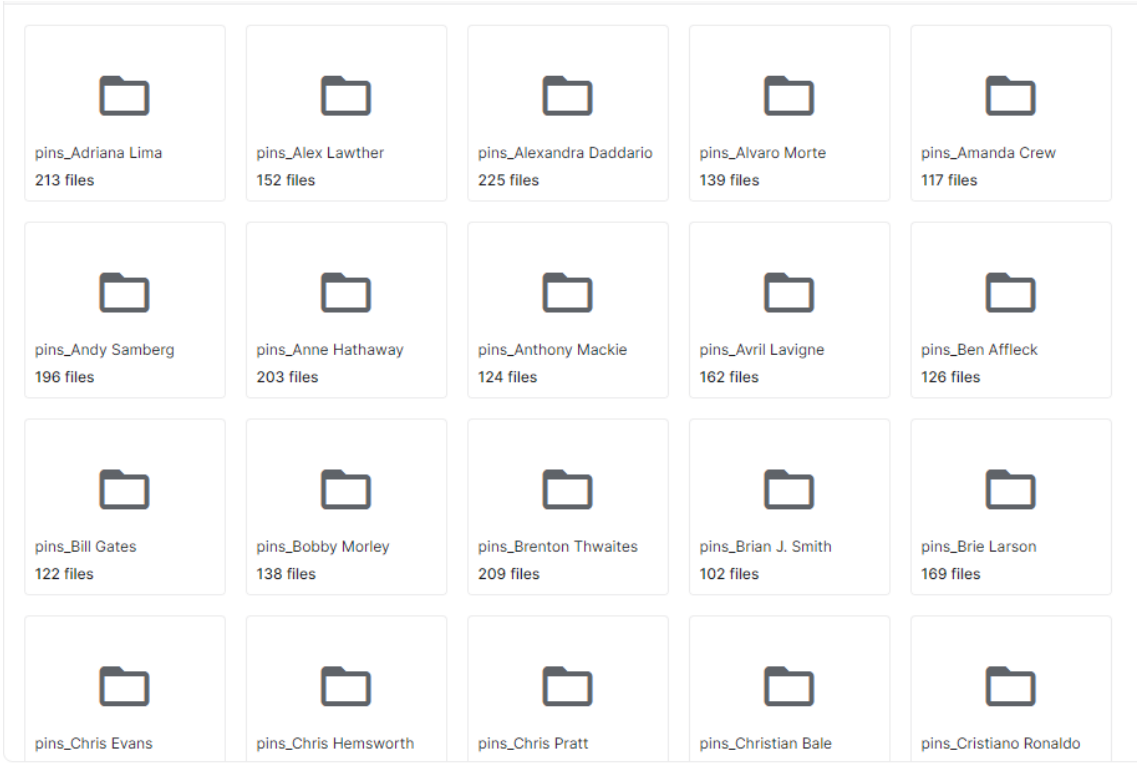
6.6 Security

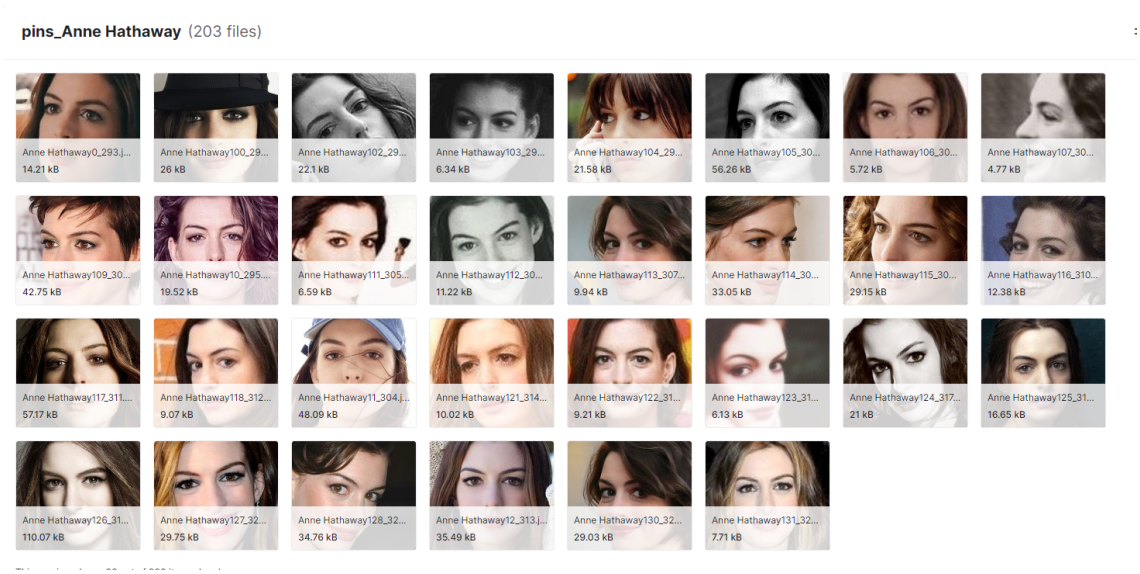
Each user will have a secured profile, The user's readings are sent to the cloud as an encrypted file. The file is then decrypted inside the cloud and then the readings are sent to the model to be processed. The file is then encrypted and displayed to the user.

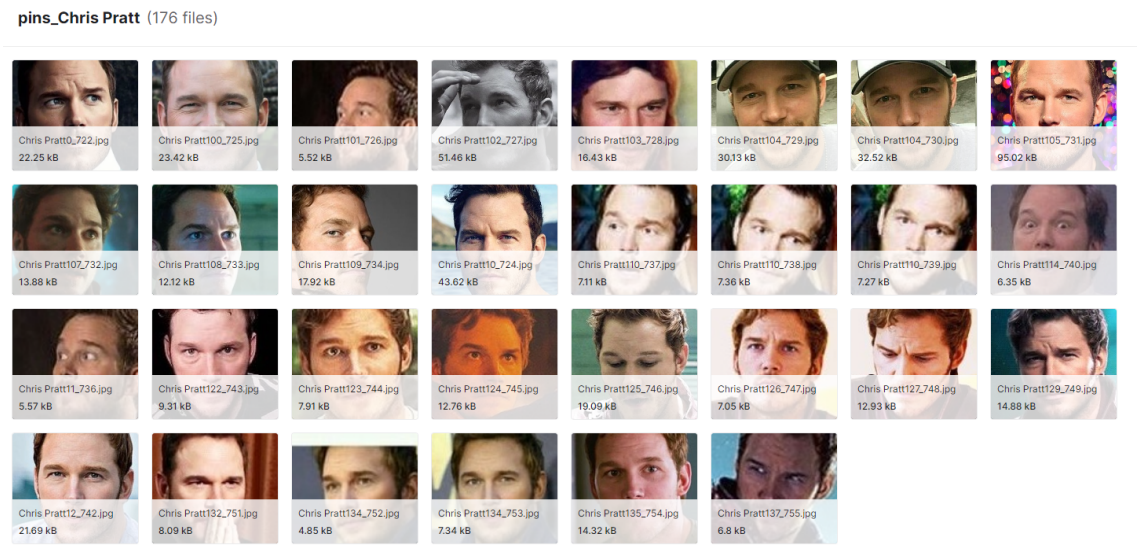
7 Data Design

Our data set is going to be mainly used for training the model for face recognition we will use LFW-People (face recognition) data set which contains 13.000 elements. To generate the best predictions possible, the machine learning model will be trained using these data sets.

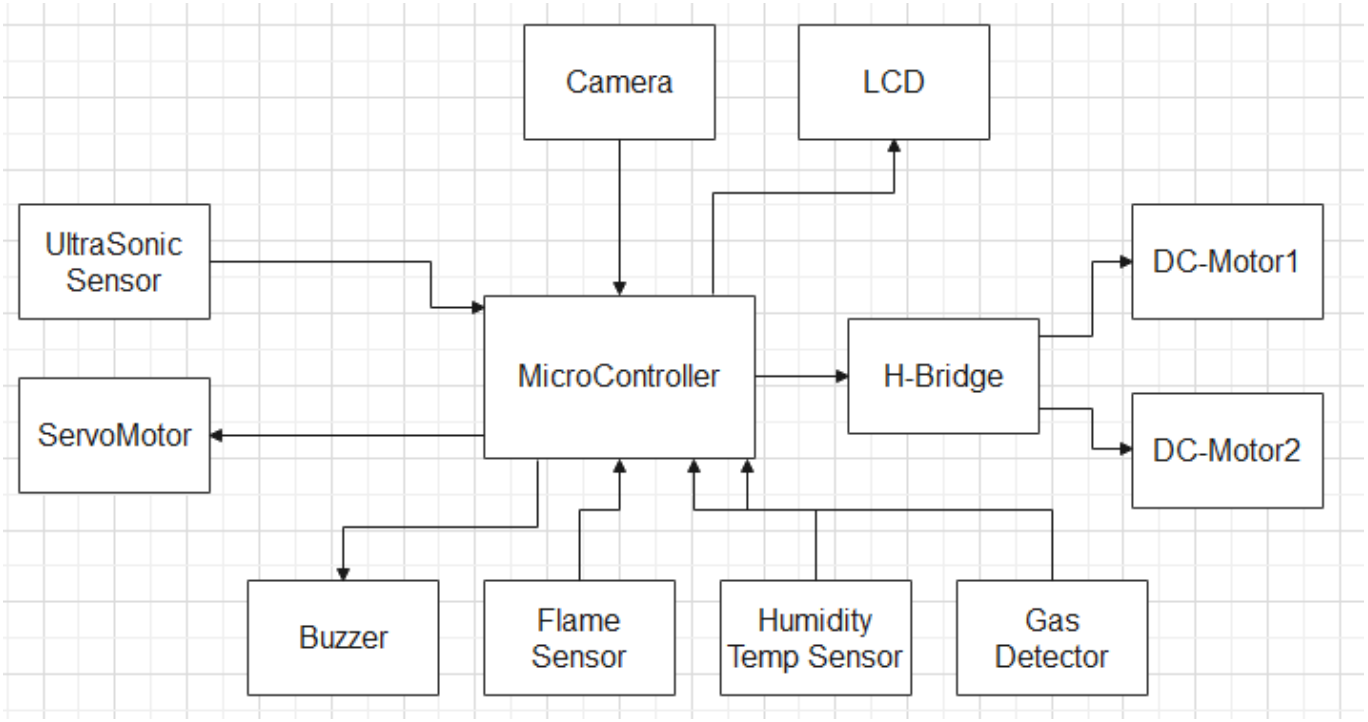
The Data Set is represented as :







8 The Block Diagram Domain Analysis



9 Operational Scenarios

- **Scenario 1**: The user will login and start setting up the robot by connecting it to his phone, internet, set the time and date and also add his face so that the robot recognizes him.
- **Scenario 2**:The alarm rings and the robot activates the buzzer and the Ultrasonic sensor and

start running until the user catch it and turn it off.

- **Scenario 3**:The gas and fire sensors detect a problem, so the buzzer activates and the user gets alert notification on his phone and have the ability to control the robot remotely and monitor the house.

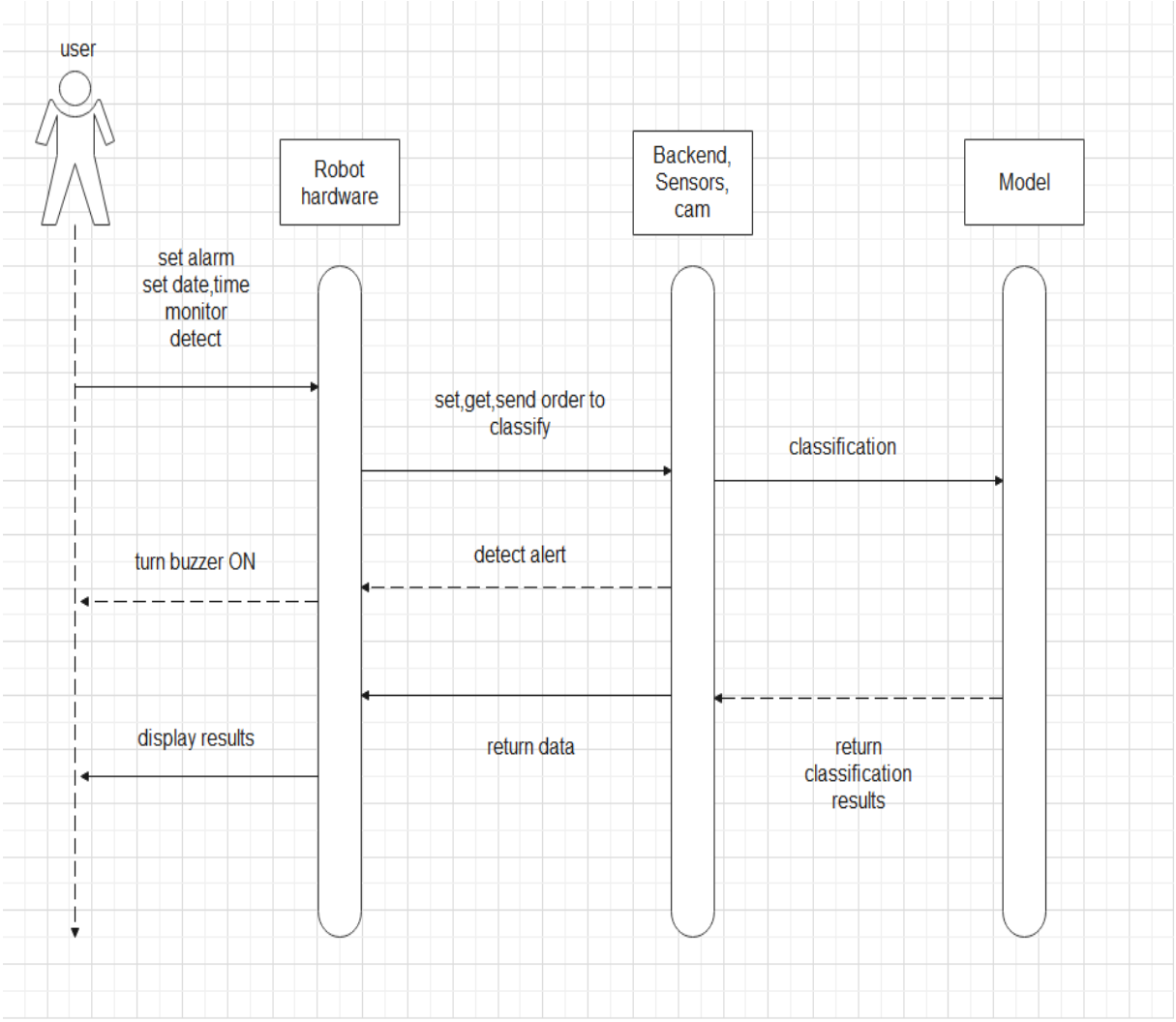


Figure 3: Sequence diagram

10 Project Plan

Tasks and Time Plan we are using Clickup Website to represent our Plan through this link :
https://app.clickup.com/42063606/v/li/234141325
And we can represent a sample look about our plan shown in figure :

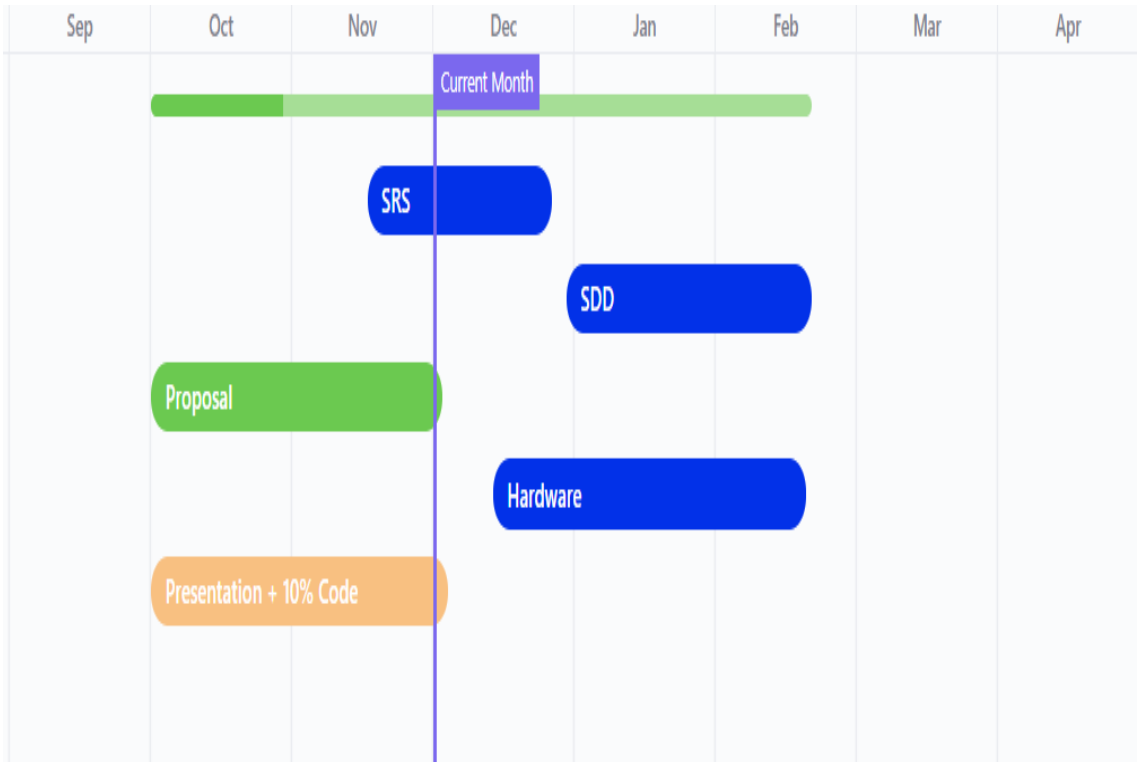


Figure 4: Time plan

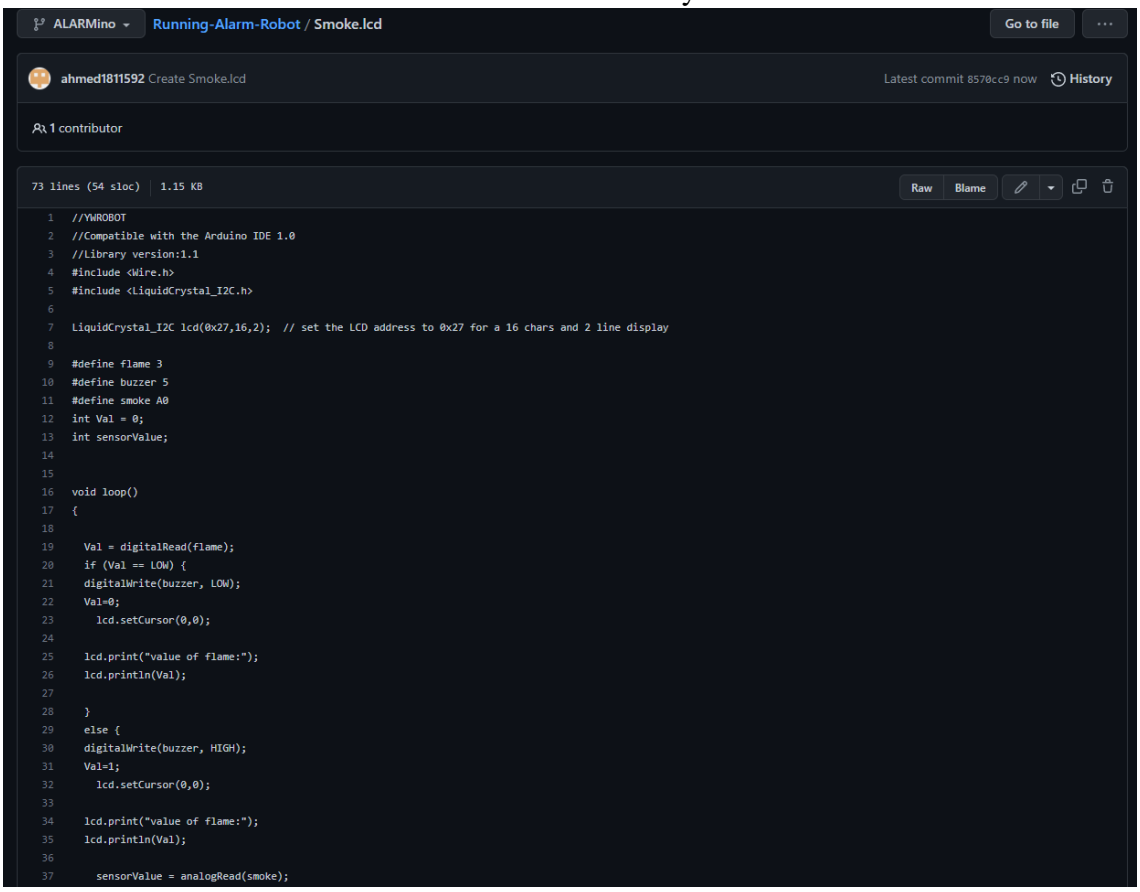
11 Appendices

11.1 Definitions

- RA is the Running Alarm.

11.2 Supportive Documents

That is Created for smoke and flame detector presented the results using lcd and buzzer and also the obstacle avoidance system.



ALARMino / Running-Alarm-Robot / Smoke.lcd — Go to file

ahmed1811592 Create Smoke.lcd — Latest commit 8570cc9 now — History

1 contributor

73 lines (54 sloc) | 1.15 KB — Raw | Blame

```
//YWROBOT
//Compatible with the Arduino IDE 1.0
//Library version:1.1
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);  // set the LCD address to 0x27 for a 16 chars and 2 line display

#define flame 3
#define buzzer 5
#define smoke A0
int Val = 0;
int sensorValue;


void loop()
{

  Val = digitalRead(flame);
  if (Val == LOW) {
  digitalWrite(buzzer, LOW);
  Val=0;
    lcd.setCursor(0,0);

  lcd.print("value of flame:");
  lcd.println(Val);

  }
  else {
  digitalWrite(buzzer, HIGH);
  Val=1;
    lcd.setCursor(0,0);

  lcd.print("value of flame:");
  lcd.println(Val);

    sensorValue = analogRead(smoke);
```

ALARMino / Running-Alarm-Robot / alarmino

Go to file

ahmed1811592 Create alarmino

Latest commit de8ef04 1 minute ago History

1 contributor

97 lines (84 sloc) | 1.78 KB

Raw Blame

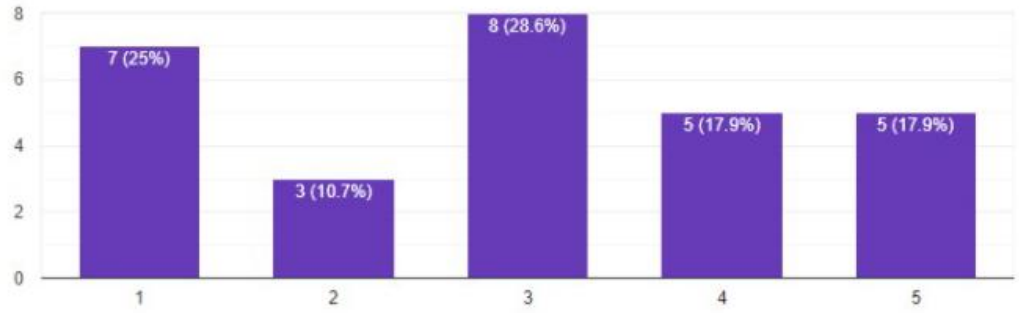
```
#include<SoftwareSerial.h>
#define speedL 10
#define IN1 9
#define IN2 8
#define IN3 7
#define IN4 6
#define speedR 5
#define trig 11
#define echo 4
long duration,distance;



void setup()
{
  Serial.begin(9600);
  for(int i=5;i<=11;i++)
  {
    pinMode (i,OUTPUT);
  }
    pinMode (echo,INPUT);

}

void Ultrasonic()
{
  digitalWrite(trig,LOW);
  delayMicroseconds(2);
  digitalWrite(trig,HIGH);
  delayMicroseconds(10);
  digitalWrite(trig,LOW);
  duration=pulseIn(echo,HIGH);
  distance=(duration/2)*0.0343;
}

void forword()
```

Our Users Survey is decomposed in their opinion to improve the system, as 61% of the people is facing a problem waking up early and 71.4% of the people think that having this robot will help them wake up in time.

Do you find it easy to wake up to alarms in the morning?

Copy

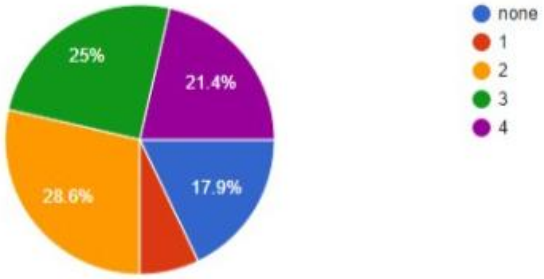
28 responses



How many times do you snooze the alarm?

Copy

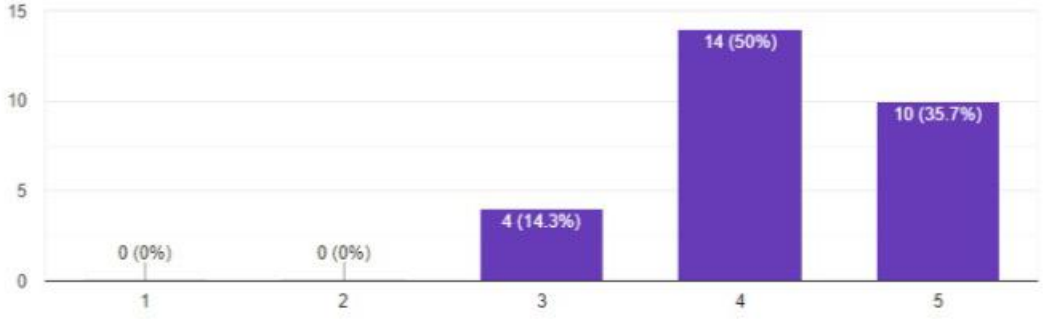
28 responses



Would you consider yourself reliant on technology?

Copy

28 responses



References

[1] Hongke Xu, Hao Chen, Chao Cai, et al. "Design and Implementation of Mobile Robot Remote Fire Alarm System". In: *2011 International Conference on Intelligence Science and Information Engineering*. 2011, pp. 32–36. DOI: 10.1109/ISIE.2011.46.

[2] Heru Supriyono and Ahmad Nur Hadi. "Designing a wheeled robot model for flammable gas leakage tracking". In: *2017 Second International Conference on Informatics and Computing (ICIC)*. 2017, pp. 1–6. DOI: 10.1109/IAC.2017.8280657.

[3] Shuran Yang, Minghe Xu, and Yanning Jin. "Meow: A Morning Companion Robot". In: *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*. HRI '20. Cambridge, United Kingdom: Association for Computing Machinery, 2020, pp. 635–636. ISBN: 9781450370578. DOI: 10.1145/3371382.3379457. URL: https://doi.org/10.1145/3371382.3379457.

[4] *Clocky the robot alarm clock that runs away from you*. URL: https://clocky.com/pages/about-us.