SMART GLASSES

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In partial fulfillment for the requirements of B.E Degree in Software Engineering.

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IN THE NAME OF ALLAH, THE MOST BENEVOLENT, THE MOST COURTEOUS

CERTIFICATE OF CORRECTNESS AND APPROVAL

This is to officially state that the thesis work contained in this report

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under my supervision and that in my judgment, it is fully ample, in scope and excellence, for the degree of Bachelor of Software Engineering in Military College of Signals, National University of Sciences and Technology (NUST), Islamabad.

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DECLARATION OF ORIGINALITY

We hereby declare that no portion of work presented in this thesis has been submitted in support of another award or qualification in either this institute or anywhere else.

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Allah Subhan'Wa'Tala is the sole guidance in all domains.

Our parents, colleagues and most of all supervisor Maj Wajahat Sultan,

Asst Prof. Athar Mohsin without your guidance.

The group members, who through all adversities worked steadfastly.

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ABSTRACT

Wearable computers can be defined as computing devices, which are worn by users on their body . In order to be wearable on the body, state-of-the art wearable computers are usually of small size and very light. In contrast to other mobile computing devices, wearable computers can be used hands-free without users need to hold the device in their hands while using it (like it is needed while using smartphones or tablets). Thus, a hands-free user experience is a key factor of wearable computers. One main type of wearable computers are smart glasses. They consist of typical computer hardware like an integrated processor, a power supply and wireless communication technologies . These components are placed in a case, which has the shape of a glasses frame. Furthermore, the glasses frame usually has a built-in head-mounted display, which is able to show information to users directly in their field of vision. Thus, users can access those information immediately without further delay.

Following are the features of the Smart Glasses

- Drowsiness detection which can detect the closure of eyes while driving or performing any important task and raise an alarm to protect against any damage or casualty:
- OLED display voltmeter, which provides the opportunity to perform minor maintenance or repair at first hand without any delay.
- Wireless alert message/Wireless text message using OLED display in front of smart glasses in absence of GSM/Internet service.

Contents

Chapter 1: Introduction

The maturing field of wearable computing aims to interweave computing devices into everyday life. This report focuses on smart glasses, one of the categories of wearable computing devices which is very present in the media and expected to be a big market in the next years. It analyses the differences from smart glasses to other smart devices, introduces many possible applications for different target audiences and gives an overview of the different smart glasses which are available now or should be available in the next few years. Interesting technological features of the smart glasses are highlighted and explained.

A device that sets a computer screen or display with the proper technology in front of a person's eyes to transmit information from the background information system is referred to as "smart glasses". The display may be reflected or projected onto the eyewear's lens, or it may be brought in as a separate device.

1.1 Overview

Simple front-end displays were the original version of smart glasses, the eyewear technology that overlays information onto a user's field of vision. Over time, we observed it advance to the point where it could carry out challenging computer-powered activities.

One main type of wearable computers are smart glasses. They consist of typical computer hardware like an integrated processor, a power supply and wireless communication technologies . These components are placed in a case, which has the shape of a glasses frame. Furthermore, the glasses frame usually has a built-in head-mounted display, which is able to show information to users directly in their field of vision. Thus, users can access those information immediately without further action.

Different Input Methods used in Smart Glasses

Serial No.	Technique	Encounters	Benefits	Equipment Used
1	Speech Analyzing	Can be noisy in shared environments	Provides a hands free experience	microphone

2	Hand held devices such as smartphone	Need of extra equipment	less opportunities for mistake while interacting with the glass or getting information	Depends on the device which is being used
3	Touch	The user taps an area of the body or a wearable gadget.	No need to carry any extra equipment	touchpad
4	Non- Touch	Eliminating concerns with input errors and power	No need of surface to interact	Absolute free hand technique
5	Head Movement	Accuracy and efficiency since just a small number of inputs may be used	There is no necessity for extra sensors or hardware.	Camera and sensor-based face tracking system
6	Palm Type	Practicability	Gives visual feedback and recognizes the location of the user's finger	Network of infrared sensors mounted to wrist

1.2 Problem Statement

We are working in different work environment to measure the voltage of the circuits and

Any electronics device, but we don't have any optimal place to see the voltage display on the voltmeter we have to turn our head this could create a dangerous situation like if our hands slip and touches the conductor wire this may cause electric shock.

Lack of communication infra-structure in most area where people, social setups, protection is provided by securities institutions. These duties require availability of mean of communication in absence of GSM/Internet services all the time.

Prolonged duties hours of driving, long drives and can cause fatigue and tiredness which could be fatal and can have severe consequences with life loss. Many accidents occur due to the reason

that drivers fall asleep due to any reason and results are fatal if drivers does wake up in time. So there should be a mechanism that should be able to raise an alarm as soon as drivers fall asleep.

1.3 Proposed Solution

a. This smart glasses have a feature of OLED display voltmeter, which provides the opportunity to perform minor maintenance or repair at first hand without any delay.

b. This smart glasses have a feature of wireless alert message in absence of GSM/Internet service.

c. This smart glasses have a feature of drowsiness detection which can detect the closure of eyes while driving or performing any important task and raise an alarm to protect against any damage or casualty

d. This smart glasses have a feature of wireless text message using OLED display in front of smart glasses.

e. Drivers can wear these glasses to stay awake even if feeling sleepy and avoid any calamity. Second seater can respond well in time if the sleeping alarm is raised.

1.4 Objectives

1.4.1 General Objectives:

"To build an innovative state of the art glasses that is a combination of hardware and software integration to provide wireless communication, voltmeter and drowsiness detection features to provide administration support and safety measures for the users."

1. Academic Objectives:

1. Development of a smart and intelligent Smart Glasses System
2. To implement wireless communication techniques and produce the desired results
3. To increase productivity by working in a team
4. To design a project that contributes to the welfare of society

1.5 Scope

This project finds its scope wherever there is communication requirement, vehicle driving, and security duties. It is an innovating state of the art software integrated hardware prototype , providing a smart administrative tool to reduce the time for passage of important information, accidents on the roads, accidents while handling electrical equipment for maintenance to save the sacred life inside it as its not only about saving a single life but many lives.

The users of end product are as follows:

- Pak Army Soldiers/ personnel
- Drivers
- Sentry
- TM shop specialists
- General Public

1.6 Deliverables

1.6.1 Eagle eye

It serves as a eagle eye to read and decide any course of action without any delay as well as remain awake and active to perform the duties of any nature with help of machine which can save you from any calamity.

1.6.2 Object of interest:

Human being on duty, performing electrical maintenance, patrolling or sentry duty is the object of interest for these smart glasses which can know that glasses is on and its assistance is required. It can be a mean for supervisor to check the vigilance of user and take corrective measures in above mentioned point of interest.

1.7 Relevant Sustainable Development Goals

Industry, Innovation and infrastructure is our SDG

1.8 Structure of Thesis

Chapter 2 includes the background and analysis research on which this thesis is founded, as well as the literature review.

Chapter 3 covers the design and development of the project.

Chapter 4 comprises the conclusion of the project.

Chapter 5 highlights the future work needed to be done for the commercialization of this project.

Chapter 2: Literature Review

A new product is launched by modifying and enhancing the features of previously launched similar products. Literature review is an important step for development of an idea to a new product. Likewise, for the development of a product, and for its replacement, related to current problem at hand, a detailed study regarding all similar projects is compulsory. Our research is divided into the following points.

- Industrial Background
- Existing solutions and their drawbacks
- Research Papers

2.1 Industrial background

The market has recently seen the introduction of smart glasses. The see-through optical display that is included into smart glasses is placed directly in front of the user's eyes. It is considered to be the definition of augmented reality when a human user can observe both the physical surroundings and the virtual material displayed on the display. Right now, smartphones rule the augmented reality market for mobile devices. One of the largest smartphone makers, Apple Inc., for instance, just unveiled its AR Kit augmented reality toolbox. Over the next ten years, we'll see a change in mobile technology from smartphones to smart eyewear. According to market research, following smartphones, smart glasses are predicted to overtake them as the dominant mobile gadget.

2.2 Existing solutions and their drawbacks

In deduction, improved reality on mobile devices is seen as having its beginnings with today's smart glasses. They are still regarded as a basic device, though, because significant problems like shoddy CPUs, meagre battery life, and tiny screens haven't been addressed yet. The input techniques for smart glasses are not well described, which is appropriate given the focus of this article. Although smart glasses are expected to be useful, we are unsure if customers will accept them for daily use in the same manner that they do today's smartphones due to difficulties with inputs and power managements. However, it appears that smart glasses will first be used as a variety of specialized task-oriented gadgets, such as industrial glasses, smart helmets, athletic activity coaching gadgets, and the like.

Different solutions are previously being provided for the problem in hand, but every product has some pros and cons. Following are some solutions which are already being prepared and being implemented.

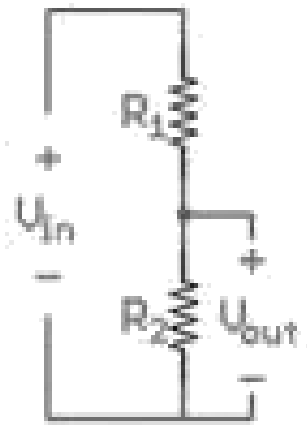
- Microcontroller with fixed control
- Systems providing one but missing other.
- Integration is not available as per the requirement and our dynamics of work and need

Chapter 3: Design And Development

3.1 Working Principle

When we switch on the button it takes the voltage of 9V the boasters that relate to the rechargeable battery of 3 volts and its suppliers the voltage to the Arduino Nano and through Arduino Nano it supplies the voltage to whole of the circuit.

For Voltage measuring we used the Arduino pin A1 and then it calculates the voltage according to the voltage divider rule we use one resistor of 100k and other is 29k.After calculating it will display the voltage on the Oled display.



After calculating it will display the voltage on the Oled display.

For IR sensor we used transmitter and receiver to get the IR signal to check whether the circuit is complete or not. If person wake up and IR rays absorbs eyes ball and IR value will be 1 and Buzzer will not beep in this case and in second case if the person is sleeping then IR rays reflect back and IR value would be 0 then buzzer will beep.

For touch sensor we use wire like a antenna that detect the skin whether the person wears or not wear the glasses. If person wear the glasses the value would be 1 or if user is not wearing the glasses then value would be 0 and user is not wearing the glasses.

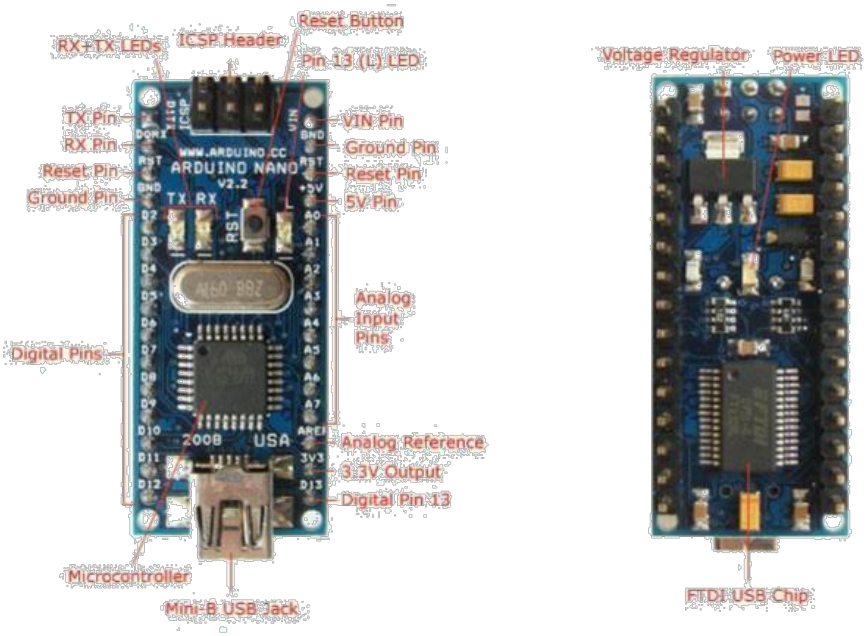
Bluetooth modules use UART communication protocol that communicate through SDA and SCLK pins that attach with Arduino to get the message from receiver and send the message from transmitter.

COMPONENT'S

1) Arduino Nano
2) Touch Sensor
3) IR Sensor
4) Bluetooth Module
5) Adafruit OLED
6) Buzzer
7) light Bulbs (SMALLS)
8) Chargeable Battery (3v)
9) Voltage Boaster (9v)
10) Multi meter Probes
11) Resistors
12) Glasses
13) Wires

ARDUINO NANO

Arduino Nano is built around the ATmega328 (Arduino Nano 3.0) or ATmega168 (Arduino Nano 2.x). It comes in a different packaging but has about the same capabilities as the Arduino Duemilanove. It only lacks a Direct Current socket and utilizes a USB connection as opposed to a conventional one. GraviTech created and is manufacturing the Nano.

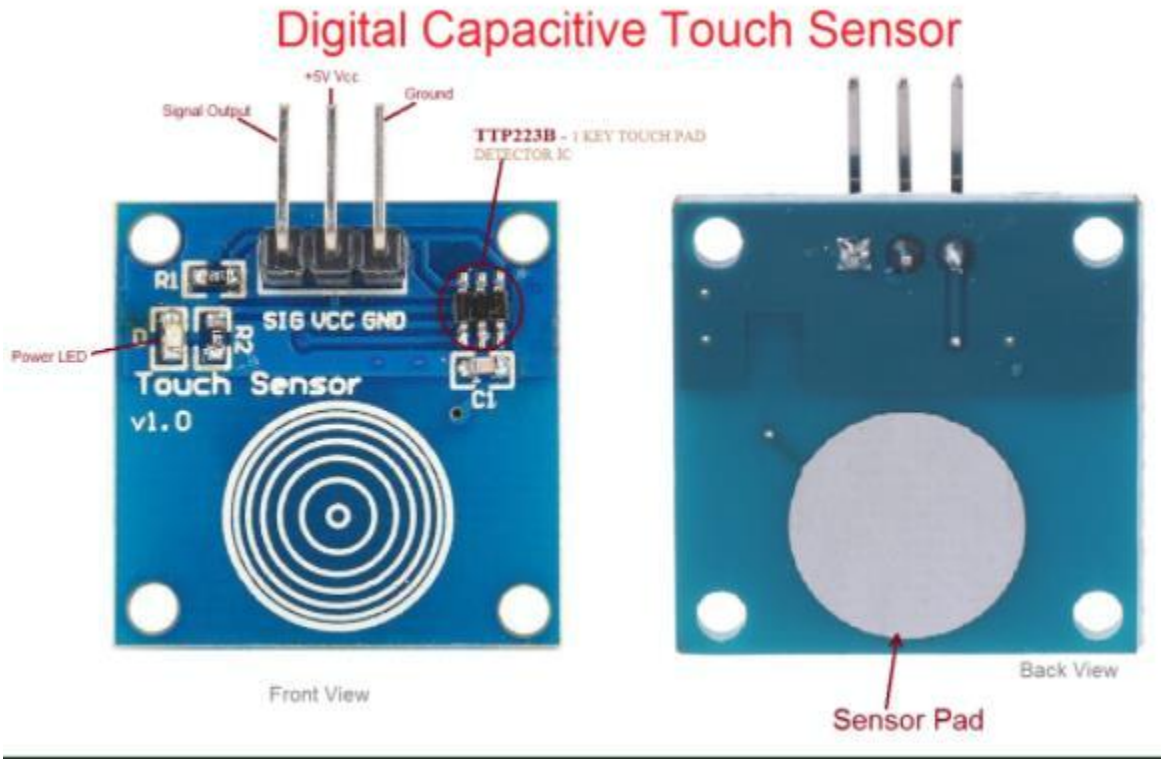


A computer, another Arduino, or other microcontrollers may all be communicated with using the Arduino Nano's many communication features. UART TTL (5V) serial communication is offered by the ATmega168 and ATmega328 and is accessible on digital pins 0 (RX) and 1. (TX). This serial connection is routed through USB by an FTDI FT232RL on the board, and the FTDI drivers (included with the Arduino software) provide computer applications access to a virtual com port. Simple textual data may be delivered to and received from the Arduino board using the serial monitor found in the Arduino software. When data is being communicated between the FTDI chip and USB connection to the computer, the Receiver and Transfer LEDs on the board will flash (but not for serial communication on pins 0 and 1). I2C (TWI) and SPI communication are also supported by the ATmega168 and ATmega328. To make using the I2C bus easier, the

Arduino software comes with the Wire library.

TOUCH SENSOR

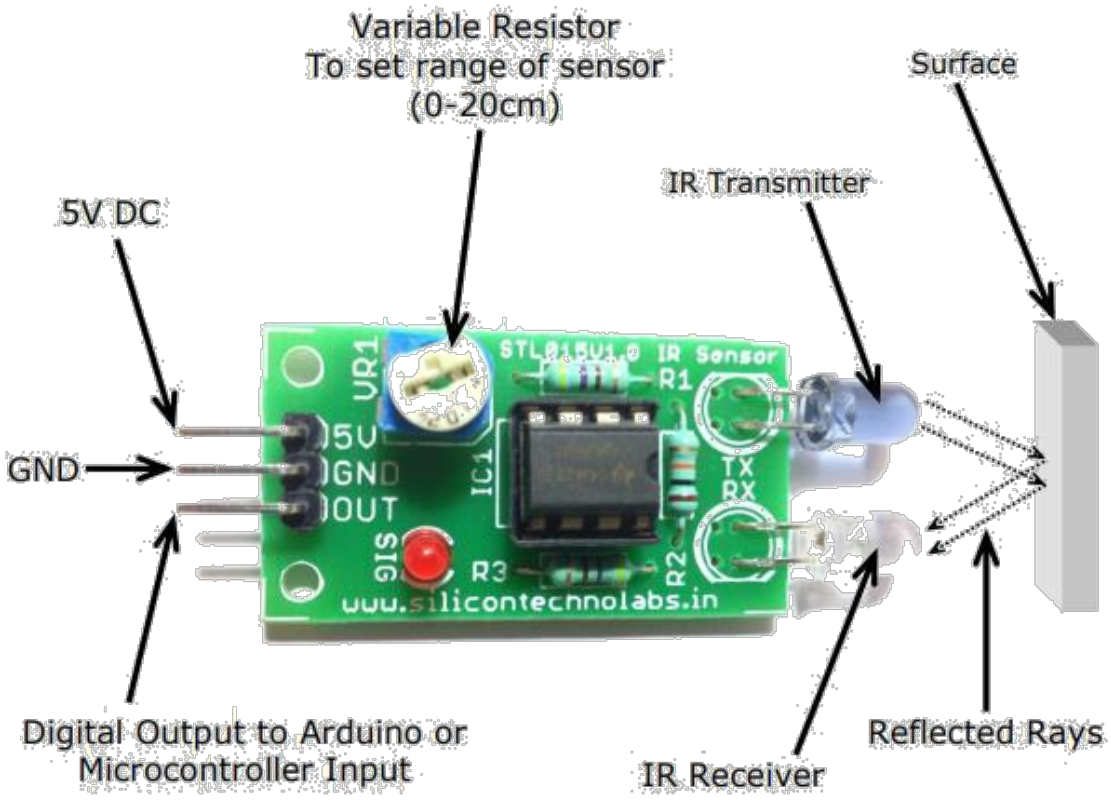
The touch pad detector IC TTP223 provides 1 touch key. With a variety of pad sizes, the touching detecting IC is intended to replace conventional direct button keys. For DC or AC applications, low power consumption and a wide working voltage are essential qualities of the contact.

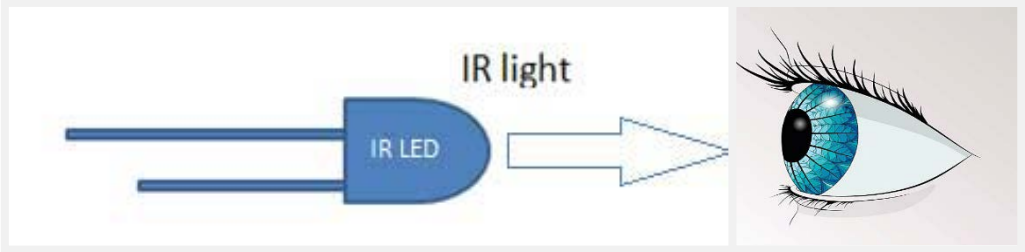


IR SENSOR

Your line follower robot and obstacle avoidance robot can identify lines and adjacent objects with the Multipurpose Infrared Sensor accessory. The sensor detects reflected light from its own infrared LED to function. It can detect light or dark (lines) or even things right in front of it by measuring the quantity of reflected infrared radiation. To signal the existence of an item or detect line, an inbuilt RED LED is employed. With an internal variable resistor, the sensing range may

be adjusted. The microcontroller board or Arduino board is connected to the sensor's 3-pin header. A mounting hole for the front or rear of your robot's chassis that makes it simple to attach one or more sensors.



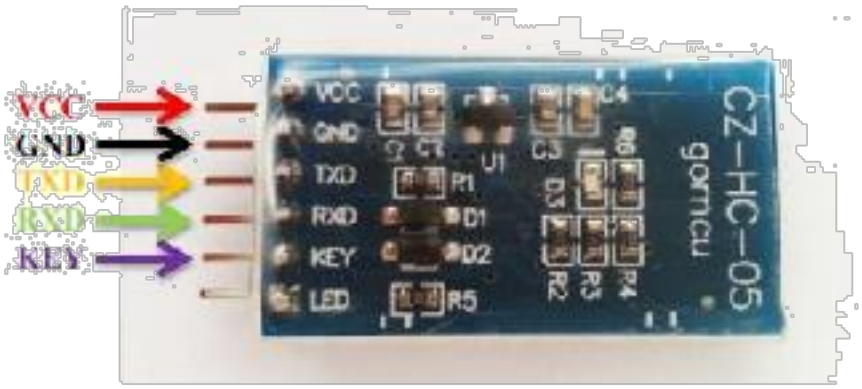


Bluetooth Module

The HC-05 Bluetooth Module is a simple Bluetooth Serial Port Protocol module designed for

establishing wireless serial connections that are transparent to both parties. Because it uses serial transmission for communication, communicating with a controller or PC is upfront. This module allows for master and slave mode change, neither data transmission nor reception can be accomplished with it.

HC-05 Bluetooth Module



OLED Display

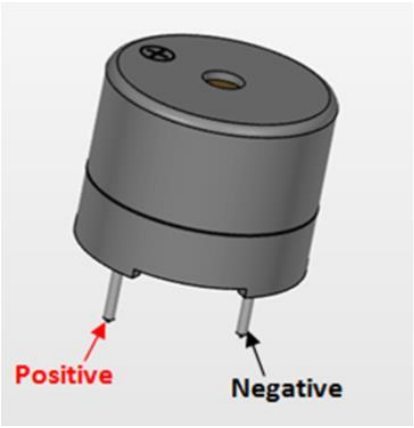
The SSD1306 is a single-chip driver and controller for organic / polymer light emitting diode dot-matrix graphic display systems. This IC was created for OLED panels. It embeds a contrast control, display RAM, and oscillator, which lowers the amount of exterior components and lowers power depletion. The hardware selectable 6800/8000 series compatible Parallel Interface, I2C interface, or Serial Peripheral Interface is used by generic MCUs to send data and commands. It is appropriate for a variety of small, portable applications, including calculators, MP3 players, and sub-displays for mobile phones.

Buzzer

The smallest yet most effective part for adding sound characteristics to our project or system is a buzzer. This component is frequently used in most electrical applications because of its tiny size and 2-pin configuration, which makes it simple to utilize on bread boards, perf boards, and even PCBs.

There are typically two different buzzer kinds available. The buzzer that is being demonstrated here is a straightforward kind that, when powered, emits a continuous beep sound. Another variety is referred to as a premade buzzer, which will be bigger than this and emit a beep. Beep. Beep. Due to the internal oscillating circuit that is there, it makes sound. The one displayed here, however, is the one that is most frequently used since it can be readily modified with the aid of additional circuits to match our need.

Simply providing a DC power supply ranging from 4V to 9V will enable you to utilize this buzzer. However, it is advised to utilize a controlled +5V or +6V DC source rather than a straightforward 9V battery. The buzzer is often connected to a switching circuit to turn it ON or OFF at the appropriate time and interval.



Multi-meter Probes

Types of multi-meters include two probes like red and black & two or three ports.
From them, one of the ports is labeled.COM for common which is used for black probe whereas the remaining ports are labeled A used for amps and mA/µA

(milliamps/micro amps). The final port is labeled VΩ used for ohms & volts. Sometimes, next labeled m A V Ω.

Glasses

Simple glasses

3.2 Definitions and Acronyms

a. Arduino Nano(micro controller) comes with a crystal oscillator of frequency 16 MHz It is used to produce a clock of precise frequency using constant voltage

b. The acronym 'OLED' stands for Organic Light-Emitting Diode. A technology that uses LEDs in which the light is produced by organic molecules. OLED displays are made by placing a series of organic thin films between two conductors. When an electrical current is applied, a bright light is emitted

c. The HC-12 is a half-duplex wireless serial communication module with 100 channels in the 433.4-473.0 MHz range that is capable of transmitting up to 1 km. This project will begin by using the HC-12 to create a wireless link between two computers and end with a second article that creates a simple wireless comm.

d. HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC

Chapter 4: External Interface

4.1 Software Interfaces

4.1.1 Arduino Nano (Microcontroller)

4.1.2 **Arduino Libraries**

4.1.3 Wire.h (I2C protocol)

4.1.4 Adafruit.gfx (LCD library)

4.1.5 dafruit. (Model no. of LCD)

4.2 Hardware Interfaces

4.2.1 Oled display

4.2.2 Lithium Battery

4.2.3 Volt sensor

4.2.4 Rf module (HC-12)

4.2.5 Bluetooth Module (HC-05)

4.3 Communication Interfaces

The HC-12 is a half-duplex wireless serial communication module with 100 channels in the 433.4-473.0 MHz range that is capable of transmitting up to 1 km. This project will begin by using the HC-12 to create a wireless link between two computers and end with a second article that creates a simple wireless comm.

4.4 System Features

1. The system should sound an alarm in case of driver goes to sleep while driving or on duty.
2. System will be able to send message without GSM/internet services up to distance of 1 km (open space) and 500m (in closed space)
3. System will give accurate voltmeter readings while performing any electrical repair/maintenance to protect the user from any calamity.
4. System display will project the correct font and size of the message to make sure the alert message is correctly readable.
5. System will allow use of mobile phone as keyboard for typing a message which will be send via RF module connected with each other through Bluetooth.

4.5 OTHER FEATURES

1. **Performance Requirements**

   When processing user input and obtaining input from external needs, the system operates quickly.

2. **Safety Requirements**

Error will be considerably minimized and in case of malfunctioning the smart glasses should shut down.

3. **Security Attribute**

   In the event of an alarm message, the subsystem will offer a high level of security and integrity of the data housed by the system.

4. **Software Quality Attributes**

   This system will permanently be accessible around-the-clock, every day of the week. Additionally, if a severe system breakdown occurs, it should be fixed within 1 to 2 working days so that users may continue doing their regular tasks in accordance with policies and procedures.

Arduino code Images

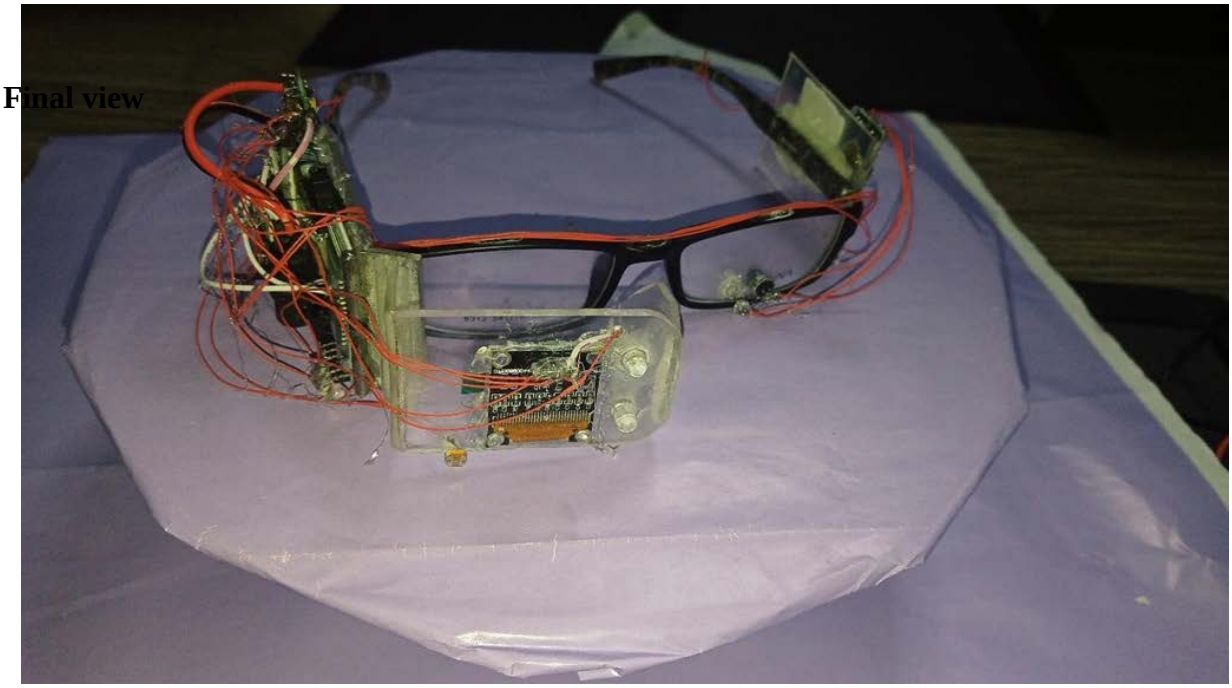
```
    digitalWrite(Light, LOW);
  }
  else {
    digitalWrite(Light, HIGH);

  }
}
void CheckEyeblink() {

  IrSensorState = digitalRead(IrSensorPin);
  if (IrSensorState == HIGH) {
    Count = 0;
  }
  else if (IrSensorState == LOW) {

    Count++;
    delay(100);

    if (Count >= 20) {
      Bt.println("Person No 854 Is Sleeping");
      Serial.println("Person No 854 Is Sleeping");
      digitalWrite(Buzzer, HIGH);
      delay(100);
      digitalWrite(Buzzer, LOW);
```

```
if (Bt.available() > 0)
{
  c = Bt.read();
  if (c=='*') {

    dataR = Bt.readStringUntil('#');
    Serial.println(dataR);
    dataD = " ";
    dataD = dataR;
    dataR = " ";


    display.clearDisplay();
    display.setTextSize(1);      // Normal 1:1 pixel scale
    display.setTextColor(SSD1306_WHITE); // Draw white text
    display.setCursor(0, 0);     // Start at top-left corner
    display.print("Msg = ");         // Use full 256 char 'Code Page 437' font
    display.println(dataD);         // Use full 256 char 'Code Page 437' font
    display.display();
    delay(5000);
```

4.6 PRECAUTION'S

1. Never operate with electricity near water.
2. Equipment with frayed cables, defective insulation, or damaged plugs should never be used.
3. Always switch off the main power before working on any outlets in your home.
4. When working, always use insulated tools.

Final view



Chapter 5: Conclusion

The fact that human eyesight is restricted to the visible region of the electromagnetic spectrum is one way to look at smart glasses. People will tend to use commercially available spectacles and extend it to difficult environmental circumstances. To become popular, companies developing smart glasses must find a method to provide a simple and straightforward user experience, customer experience, and all of that while taking proper ergonomic considerations. Although smart glasses are expected to be useful, we are unsure if customers will accept them for daily use in the same manner that they do today's smartphones due to difficulties with battery life and input methods. But it appears that smart glasses will first function as certain specific task-oriented gadgets, such as industrial glasses, smart helmets, and athletic activity coaching gadgets.

In this thesis, we discussed a smart glasses system that can provide a multi-feature glasses to handle multiple problems smartly and more efficiently than the typically used manual or indiviual slot systems by using real-time processing. Our proposed system has an advantage over other traditional systems due to the integration being used as per the requirements for the detection of objects of interest.

Techniques used in our proposed system; Image Processing techniques to process the video, frame by frame, and Machine Learning included algorithms such as YOLO and SSD, which were used to detect the objects of interest; are also briefly explained included their working and importance. The purpose of increasing productivity and overcoming problems in existing solutions is being achieved by using the modern techniques. Additionally, the objectives; smooth traffic and providing special privileges, are attained. Hence saves time as well as the prestigious lives of patients.

Simulated results are shown for two live feeds using OpenCV, which is open-source software, easy to install, and can be used in real-time. The same algorithm can be used to have live feeds for all four lanes. Only the interfacing of the cameras would be required.

Our proposed system, STCS, is cost-effective as it is purely made for the core purpose of serving Pakistan, any system that could be beneficial to its citizens. Else, similar solutions provided by other countries are very costly. Moreover, STCS provides an ease to adoption which can be adopted by beneficiaries, mass deployment can also be done and most importantly no product training is required.

Chapter 6: Future Work

Future milestones that need to be achieved to commercialize this project are the following.

6.1 SCOPE OF TECHNOLOGY

Smart glasses are utilised in a variety of fields, including education, health (as a fitness tracker that counts steps and measures heart and respiration rates), tourism (to give tours of a location), retail establishments, and for entertainment. In addition, a study on the input of games using smart glasses was carried out. According to the findings, customers preferred non-contact and non-handheld communication over employing handheld information devices, such as in-air movements. Additionally, customers preferred using their hands rather than wearable devices to make contact contributions in the absence of portable devices (51 percent versus 20 percent). Additionally, customers preferred less noticeable interactions due to concerns about social recognition and preferred in-air signals before the midsection rather than before the face (63 percent versus 37 percent).

Smart glasses may also be used to show the user the route. Additionally, it might suggest a speed for the user if they are operating a vehicle. It may also direct workers in warehouses to the goods they need to deliver, highlighting many items from the same order with the same hue.

The eye tracking technology can also be used to track the eye movement of the employee. This will help determine whether the employee is tired and needs a break or when an employee has finished all the work and is sitting idle. In construction sites, smart glasses can be augmented with the design of the building which will help the engineers to find mistakes and it will also help the workers to prevent accidents like drilling through a water pipe. These are only a fraction of possible scenarios for smart-glass applications. And it is clear that each brings a series of ethical questions that need to be answered

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