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# Micro IoT architecture to build a smart glass with basic features

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## ABSTRACT

***Smart glasses are wearable computing devices that layer information onto a user's field of view. Why Smart Glasses? Smart glasses are computing devices worn in front of the eyes. Evidently, their displays move with the user's head, which leads to the users seeing the display independently of his or her position and orientation. This report focuses on how to develop cheap smart spectacles with basic features in it. Basic features like computing humidity, time, temperature, maps for navigational purposes and a game for user's entertainment. We are going to design a micro-IoT architecture with different kinds of sensors and modules to perform the above-mentioned computations.***

***Keywords***— *Smart glass, Computing device, Wearable, Sensors, Modules*

## 1. INTRODUCTION

Smart glasses are computing gadgets worn before the eyes. Their showcases move with the user's head, which prompts the users to see the presentation freely of his or her position and orientation. Smart glasses are head-worn portable computing devices, which contain multiple sensors, modules, processing capabilities and optical head-mounted displays (OHMDs). With the processing capabilities and the OHMD, the users of smart glasses can view augmented information that is overlaid on the physical world. These abilities provide the extraordinary potential to accomplish real-time and enriched interaction between the smart glasses user and the physical world with augmented data. The visual information a wearer perceives will be in the paradigm of non-interactive augmented reality where the user can see the real world but also can perceive the virtual content created by the smart glass. In this report, we explain the micro IoT architecture to build a smart glass with basic features like temperature/humidity sensing, time computing, navigation guide and a simple game designed for user's entertainment. There are smart glasses with a single display which is placed in the peripheral vision of the user. Those displays can be used to display information to the user. Unfortunately, they cannot be used to create a diminished or virtual reality because sight on one eye is not affected. They also cannot be used to create an interactive augmented reality because virtual objects can only be seen in peripheral vision. In our micro IoT architecture, we will be building a smart spectacle with two single display pieces, one before the left lens and the other over the right lens. The display in front of the left lens will be used only when the user requires navigational guidelines. The display in front of the right lens is used when the user wants to know about the current temperature, humidity, time or when the user feels like playing the game.

## 2. MODULES

### 2.1 Temperature/Humidity

DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interfaced with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low-cost humidity and temperature sensor which provides high reliability and long-term stability.

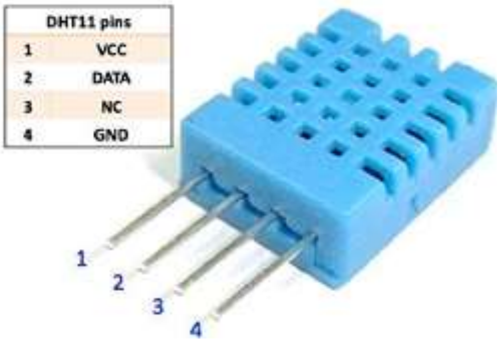


**Fig. 1: DHT11 Module**

The DHT11 recognizes water vapor by estimating the electrical opposition between two cathodes. The humidity sensing component is a dampness holding substrate with anodes connected to the surface. At the point when water vapor is consumed by the substrate, particles are discharged by the substrate which builds the conductivity between the cathodes. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes, while lower relative humidity increases the resistance between the electrodes. DHT11 sensor ought to be associated with Arduino pro mini where the code will be imported which will make the Arduino to automatically read the data from the sensor and display the resulting humidity and temperature on the OLED Display.

 

Let us assume the data received from the DHT11 Sensor to be 00100101 00000000 00011001 00000000 00111110.

This data can be separated based on the below-mentioned structure as follows


**Fig. 2: Data separation**

In order to check whether the received data is valid or not, we need to perform a small calculation. Add all the integral and decimals values of RH and Temperature and check whether the sum is equal to the checksum value i.e. the last 8 – bit data.

**00100101 + 00000000 + 00011001 + 00000000 = 00111110**

This value is the same as checksum and hence the received data is valid. Now to get the RH and Temperature values, just convert the binary data to decimal data.

**RH = Decimal of 00100101 = 37%**
**Temperature = Decimal of 00011001 = 25$^0$C**

The DHT11 measures temperature with a surface mounted NTC temperature sensor (thermistor) built into the unit.

### 2.2 Time module

To find out the current time, the RTC module is used. It is connected to the Arduino board where the code will be imported. A real-time clock is a clock that monitors the present time and that can be utilized with a specific end goal to program activities at a specific time. The RTC module has four pins. Out of those four pins, two of them namely VCC and GND are connected to the Arduino board's VCC and GND respectively. The other two analog pins are connected to the toggle switches which can be used to know the current time. Working with the RTC requires two imperative advances: Setting the present time, with the goal that the RTC recognizes what time is it. Retaining the time so that the RTC always gives the right time, even when it is switched off. Set the present time in the Real Time Clock. For setting the present time you have to change the code gave. Set your present time in the capacity setDS3231time(). The parameters for the function are: seconds, minutes, hours, the day of the week, date, month and year (in a specific order). Sunday is the day 1 of the week and Saturday is 7.

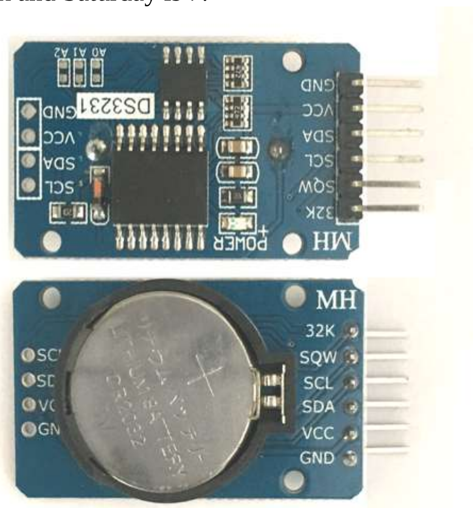


**Fig. 3: RTC Module**

### 2.3 Gaming module

The game that we've provided for the user to play is the SNAKE game. While the user plays the game, the respective scores are updated with respect to the number of food dots that the snake consumes. This can be carried out by importing the game's code into the Arduino board which will be connected to a 5 channel way tactile switch. The 5 channel way tactile switch is used to direct the snake towards the food dots.

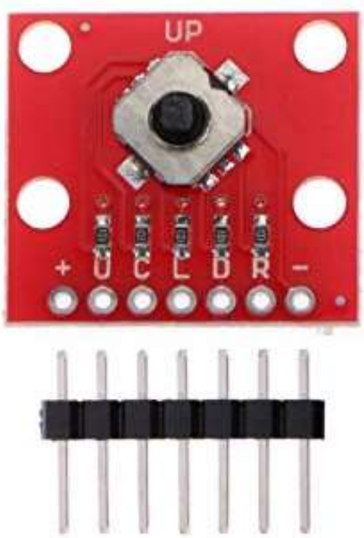


**Fig. 4: 5 channel way tactile switch**

### 2.4 Navigation module

When the user needs help with navigation, the smart spectacles can be used. To implement this we've used a Bluetooth module through which the spectacles are connected to our mobile phones and the user can access Google maps for navigation. Arduino Micro-controller having ATmega328p microprocessor is programmed to connect with a mobile phone through a smartphone application. The Bluetooth module, HC-05 is interfaced with ATmega328p to establish a connection with mobile phones. The OLED display is interfaced with the microprocessor ATmega328p which displays the required information received from mobile phones.

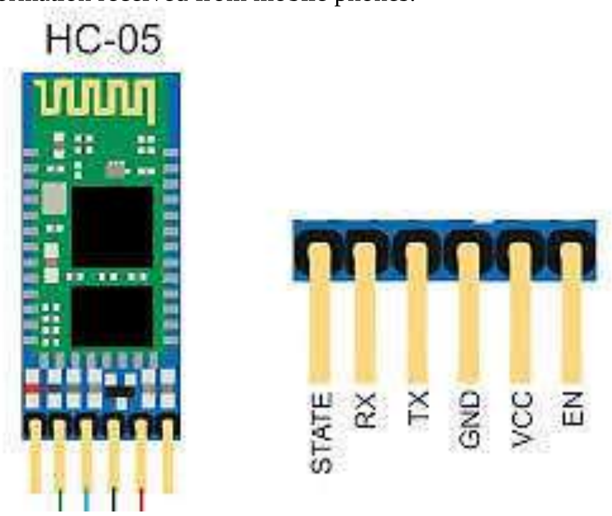


**Fig. 5: Bluetooth Module**

## 3. SYSTEM ARCHITECTURE

The display piece before the right lens of the spectacles displays information about the current temperature, humidity, time and a small game for the user's entertainment. The following diagram represents the system architecture for these features.

 

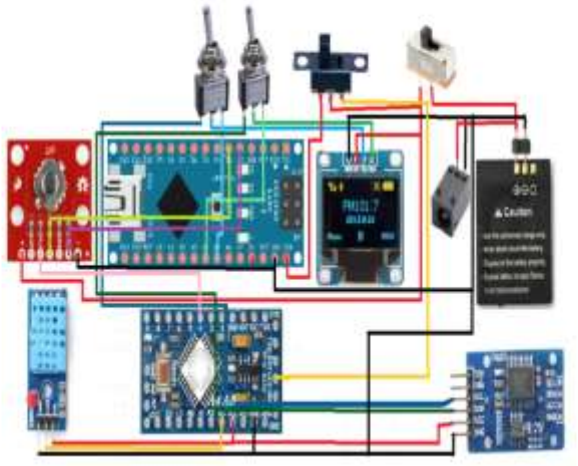

**Fig. 6: System architecture of right display**

The display piece before the left lens of the spectacles displays the information required for navigation purposes. The system architecture behind the left lens is represented below.

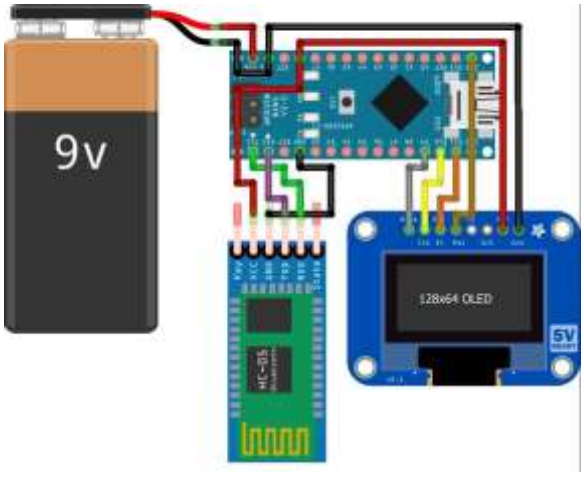


**Fig. 7: System architecture of left display**

## 4. FUTURE ENHANCEMENTS

A camera can be added to the smart spectacles for facial recognition. It can also be improvised to provide a virtual reality environment. Instead of using a 5 channel way tactile switch a touchpad can be introduced. Audio features can be added for navigation and several other purposes. Voice control specifications for visually impaired users.

## 5. CONCLUSION

Thus in this report, we've demonstrated how to build a smart spectacle with basic features. Basic features like computing humidity/temperature, time, maps for navigation and a game for user's entertainment. The micro IoT architecture we designed is cost-effective and emits less harmful radiations compared to other smart glasses in the market. There are a lot of interesting applications for such smart spectacles compared to other traditional computing devices. Even though the current prototype of smart spectacles has its own pitfalls, it can be assured that in the near future smart spectacles will be a part of our everyday life.

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