# SmartCare: Assistive Eyewear for Medicine Recognition and Safety Monitoring of Memory-Impaired Patients

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***Abstract*—Memory-related disorders make it difficult for patients to manage daily activities like taking medicines on time and staying in safe areas. This paper presents SmartCare, an assistive eyewear system to help such patients. The system includes features like face recognition, GPS tracking, border alerts, and medicine reminders. The face recognition feature helps patients identify familiar individuals, while the medicine identification module ensures correct medication intake. The reminder system alerts patients at scheduled intervals, improving adherence to prescribed treatments. Medicines are identified using coloured containers, which makes the system simple and easy to use. The main aim of this system is to help patients take the correct medicine and improve their safety. The system is designed to be cost-effective, portable, and scalable, making it suitable for real-world healthcare applications and future enhancements.**

***Index Terms*—Assistive healthcare system, wearable device, medicine reminder, GPS tracking, patient safety.**

## I. INTRODUCTION

The rapid growth of the global elderly population has led to an increase in age-related cognitive disorders such as Alzheimer's disease and Dementia. These conditions significantly impair memory, decision-making ability, and daily functioning, making it difficult for affected individuals to perform routine activities independently. Patients suffering from such disorders often face challenges in recognizing familiar individuals, remembering medication schedules, and navigating safely within their environment. This not only reduces their quality of life but also places a substantial burden on caregivers and healthcare systems.

In recent years, advancements in embedded systems, Internet of Things (IoT), and computer vision technologies have opened new possibilities for developing intelligent assistive solutions. Wearable devices, in particular, have gained attention due to their portability, real-time monitoring capabilities, and user-friendly nature. These systems can provide continuous assistance to patients while ensuring minimal intrusion into their daily lives.

This paper proposes a SmartCare: Colour-Based Assistive Eyewear System for Memory-Impaired Patients, which integrates multiple functionalities into a single compact and efficient wearable device. The system is designed to assist patients by combining face recognition, colour-based medicine identification, location tracking, medicine reminders, and emergency alert mechanisms. The central processing unit of the system is an embedded microcontroller that coordinates data acquisition, processing, and communication between various modules.

The face recognition module enables patients to identify familiar individuals, thereby improving social interaction and reducing confusion. The colour-based medicine recognition system assists patients in selecting the correct medication, minimizing the risk of incorrect drug intake. Additionally, a scheduled medicine reminder module ensures timely medication adherence. The integrated GPS module facilitates real-time location tracking, while the border alert mechanism enhances patient safety by detecting when the user moves beyond predefined safe zones. An alert system is incorporated to notify caregivers in case of emergencies or abnormal conditions.

By integrating these functionalities, the proposed system aims to provide a comprehensive assistive solution that enhances independence, safety, and quality of life for memory-impaired individuals. Furthermore, the system is designed to be cost-effective, scalable, and adaptable for future enhancements such as artificial intelligence-based decision-making and smart healthcare integration.

## II. LITERATURE SURVEY

Several research works have been carried out in the area of healthcare monitoring and medicine reminder systems.

In 2020, Patel et al. developed an IoT-based medicine reminder system that alerts patients to take medicines on time and allows caregivers to monitor the schedule remotely. However, the system does not ensure whether the correct medicine is taken [1].

In 2021, Kumar et al. proposed a wearable health monitoring system for elderly patients. The system uses sensors and GPS to track patient location and generate alerts when the patient leaves a safe area. However, it does not include any method for medicine identification [2].

In 2019, Lee et al. introduced a vision-based pill recognition system using image processing techniques such as colour and shape analysis. Although the system gives good accuracy, it requires a large dataset and high processing power [3].

In 2022, Sharma et al. developed wearable assistive devices for patients with cognitive impairments. The system provides reminders and monitoring features, but it does not include a simple method for identifying medicines [4].

In 2020, Singh et al. proposed a smart medicine dispenser system that automatically provides medicines at the correct time. However, the system is bulky and not suitable for wearable applications [5].

In 2021, Rahman et al. developed a GPS-based tracking system for patient safety. The system sends alerts when the patient moves outside a predefined boundary. However, it does not include medicine reminder features [6].

In 2018, Chen et al. proposed an IoT-based healthcare monitoring system that collects patient data and sends it to caregivers. The system improves monitoring but does not address medicine management [7].

In 2022, Gupta et al. developed a smart reminder system using mobile applications. It helps patients remember their medicines but does not confirm the correct medicine intake [8].

In 2019, Wang et al. introduced a wearable device for elderly care that provides alerts and health monitoring. However, it lacks a proper system for medicine identification [9].

In 2021, Ali et al. proposed a colour detection-based object recognition system using simple image processing techniques. This method reduces complexity but is not applied specifically for medicine identification in healthcare systems [10].

From the above studies, it is clear that most existing systems focus on either monitoring or reminders. Very few systems provide a simple and practical method for medicine identification. Therefore, the proposed SmartCare system combines monitoring features with a colour-based container method to provide a simple and effective solution.

## III. METHODOLOGY

The SmartCare system is designed as a wearable assistive device that helps memory-impaired patients in their daily activities. The system combines different modules to provide safety monitoring and medicine reminders.

A block diagram of the system is shown in Fig. 1. It includes the ESP32 microcontroller, camera module, GPS module, and alert system. The ESP32 acts as the main controller and manages all operations.

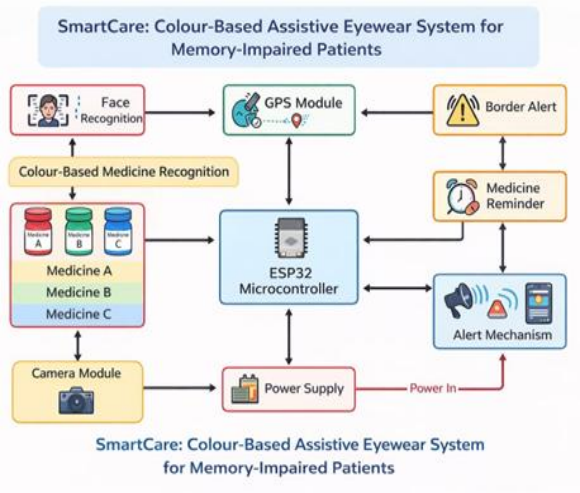


Fig. 1. Block Diagram

The main specifications of the system:

1) Face Recognition
2) Medicine Recognition

3)Medicine Reminder
4)Location Tracking
5)Border Alert

FACE RECOGNITION

The module identifies the known individuals by comparing the live captured images with al-ready-made data set of images. This is done to clarify whether the person in front of the patient is a family member or not. If not, an alert is provided to the family members. The face detection is done using image processing algorithms. The image processing begins with real time image acquisition by capturing the live images using a camera module. The captured images then undergo through preprocessing techniques grayscale conversion and noise reduction.

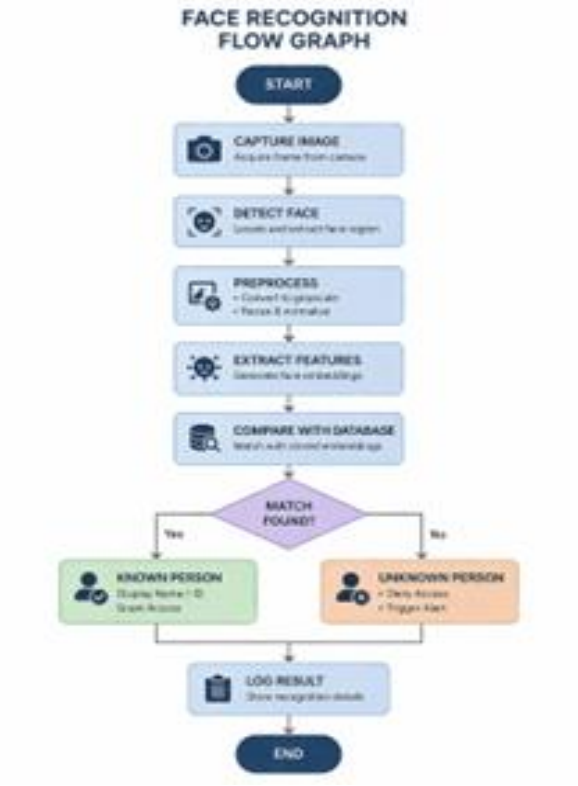


Fig. 2. Face Recognition

In a RGB image, each pixel consists of three colors, red, green and blue. By converting the RGB image into grayscale image, the three-channel image is converted into a single channel image where only the brightness information is considered. The conversion reduces processing time and memory usage, reduces computational complexity and improves performance of detection Algorithm.

Filters such as Gaussian blur are applied to remove noise, improve the quality of the image. After the image acquisition, the important features of face like eyes, nose, mouth, etc. are extracted for the recognition.

Then using the algorithms like haar cascade classifier and histogram of oriented gradients, the face detection is done by identifying the patterns and structures.

Once the face is detected, it is compared with the dataset of images stored. This enables the module to recognize the close family members.

COLOR BASED MEDICINE IDENTIFICATION

In this module for example; 3 medicines are taken in 3 different boxes of 3 different colors. Then the module identifies the medicine by the color of the boxes used. It recognizes the medicine and make the patient aware about it.

In this first of all the image acquisition is done by capturing the image of the medicine box. For the medicine detection the module uses color segmentation technique.

The captured image in RGB format is converted to HSV format that is Hue saturation value. It makes the detection more accurate under varying lighting conditions. After the conversion define the color range. We know that computers can't understand red or blue colors so we define each colors into pixel values or numerical values. Each color is defined using lower and upper limits.

Following the defining step, the image is then masked using white and black colors. Original image contains many colors. After masking it becomes only two colors, white and black. White represents the required color, and black represents the unwanted color. Masking removes unwanted colors, making detection faster and more accurate.

The system then extracts only the regions that match the selected colors. Then it is compared with the already made data set of color boxes of medicines.

MEDICINE REMAINDER SYSTEM:

For memory impaired patients, it is crucial to remind them of the medicine consumption on time. In this module, the medicine timings are predefined in the system. The system continuously checks the time, and when it matches with prescheduled time, an alert is made using a buzzer, and in this prototype a message is shown on the LCD display.

For time monitoring, the system uses an internal timer or RTC (real time clock). RTC keeps an accurate time even when power is off. [ESP32, RTC module]

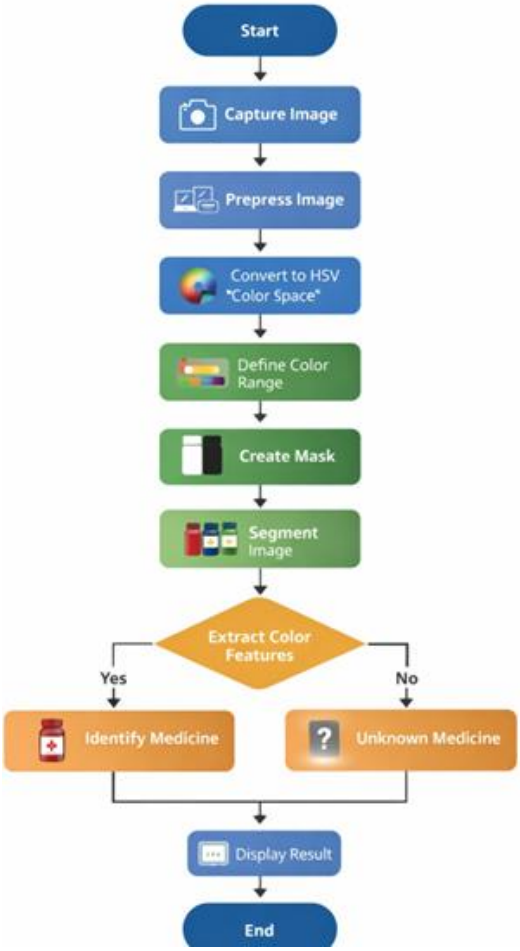


Fig. 3. Medicine Recognition

LOCATION TRACKING SYSTEM

The location tracking module is used to monitor the real time position of the patient and ensures their safety. For tracking the location, we use a GPS module. GPS module receives the satellite signals and examines the latitude and longitude of the module. This data is sent to esp32.So the location tracking is done.

BORDER ALERT SYSTEM

If the patient moves outside a safe distance, an alert is generated. In this module a safe area is predefined. The movements of the patients are monitored using a GPS module. And if patients cross the safe zone, the system alerts them. It improves safety, enhances real time monitoring, and alerts caregivers too.

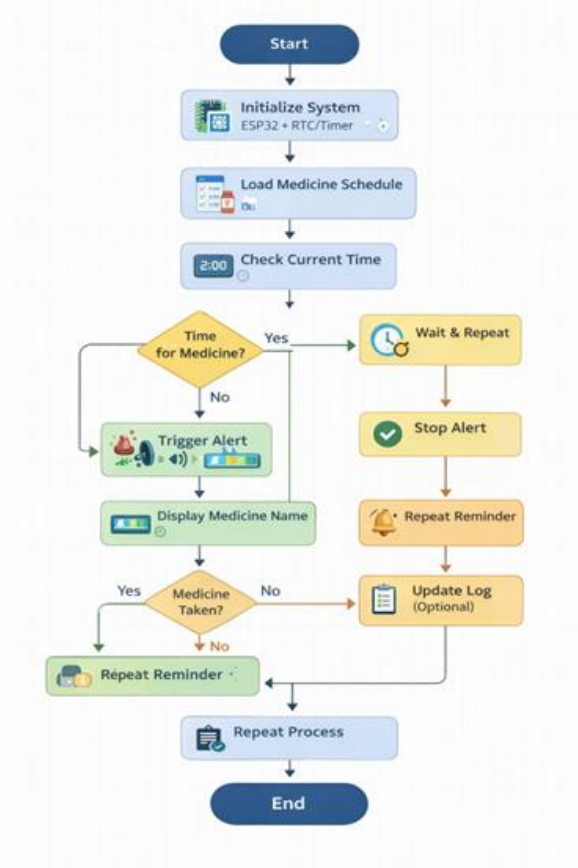


Fig. 4. Remainder

The camera module is used for two purposes. It performs face recognition to identify the user and also detects the colour of medicine containers. This helps in identifying the correct medicine.

The GPS module is used to track the location of the patient. A safe area is predefined in the system. If the patient moves outside this area, an alert is generated and sent to the caregiver. The system also includes a reminder function. The medicine schedule is stored in the system, and alerts are given at the correct time to remind the patient to take medicines.

For medicine identification, a simple colour-based method is used. Medicines are stored in containers with different colours such as red, green, and blue. When the patient picks a container, the camera detects its colour and matches it with the stored data. Based on this, the system identifies the medicine and confirms whether it is correct.

This method reduces complexity and avoids the need for large image datasets. It also makes the system easier to implement using embedded hardware.

*A. circuit diagram*

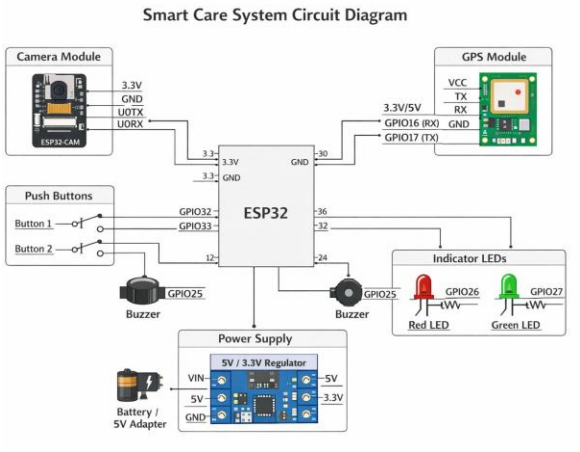


Fig. 5. Circuit Diagram

## IV. EXPECTED RESULTS

The SmartCare system is expected to help patients take medicines on time and reduce mistakes in medicine intake. The reminder feature ensures proper medication schedule.

The colour-based container method makes it easy to identify medicines without using complex image processing. This improves system reliability.

The GPS tracking feature helps caregivers monitor patient location. If the patient moves outside the safe area, alerts are generated. It is expected to function as an intelligent assistive solution for memory-impaired patients by integrating embedded systems, computer vision, and IoT technologies. The system will be capable of accurately recognizing familiar faces, thereby helping patients identify caregivers and reducing confusion or anxiety. In addition, the medicine identification module will enable the system to distinguish between different medicines based on visual characteristics, minimizing the risk of incorrect medication intake. The medicine reminder feature is designed to provide timely alerts through audio and visual cues, ensuring adherence to prescribed medication schedules. Furthermore, the incorporation of a GPS-based location tracking module will allow continuous monitoring of the patient's position, enabling caregivers to track movement in real time. The border alert system enhances safety by detecting when the patient moves beyond a predefined safe zone and triggering immediate alerts. Overall, the system is expected to improve patient safety, promote independence, and reduce the burden on caregivers by providing a reliable, real-time monitoring and assistance platform. Overall, the system improves patient safety and supports daily life management.

## V. FUTURE SCOPE

The proposed Smart Care system can be further enhanced by integrating advanced technologies to improve its accuracy, functionality, and usability. One of the major improvements can be the incorporation of deep learning-based image recognition, which would enable more precise identification of medicines and faces under varying lighting and environmental conditions. Instead of relying only on color-based detection, the system can be trained using large datasets to recognize different medicine shapes, labels, and packaging, thereby increasing reliability.

In addition, the system can be extended by developing a mobile application that allows caregivers to monitor patients remotely. This application can display real-time lo-cation, medicine schedules, and alert notifications, ensuring better communication between the patient and caregiver. Cloud integration can also be implemented to store patient data, medication history, and activity logs for long-term monitoring and analysis.

The Smart Care system can also be improved by incorporating voice assistant technology, enabling patients to interact with the system through simple voice commands. This would make the system more user-friendly, especially for elderly patients who may find it difficult to use buttons or screens. Furthermore, multilingual support can be added to make the system accessible to a wider range of users.

Another potential enhancement is the integration of health monitoring sensors, such as heart rate, body temperature, and fall detection systems. This would transform the system into a comprehensive healthcare monitoring device capable of providing real-time health updates and emergency alerts. The addition of indoor positioning systems can also overcome the limitations of GPS in indoor environments.

Finally, future developments may focus on making the device more compact, wearable, and energy-efficient. By optimizing power consumption and using advanced battery technologies, the system can achieve longer operational life. With these improvements, the Smart Care system has the potential to evolve into a

fully autonomous and intelligent healthcare assistant, significantly enhancing patient safety, independence, and overall quality of life.

## VI. CONCLUSION

This paper presented SmartCare, an assistive eyewear system for memory-impaired patients. The system includes features such as face recognition, GPS tracking, border alerts, and medicine reminders. A colour-based container method is used for medicine identification, which simplifies the system. The proposed system improves patient safety and helps in daily activities.

## ACKNOWLEDGMENT

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