Smart Aid and Relief Rover

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***Abstract*—The "Smart Aid and Relief Rover" project aims to improve the distribution of essential goods like food and medicines in Bangladesh. By using specially equipped trucks, the system allows people to access products with their valid IDs, reducing unfair distribution. Automated vending machines inside the trucks ensure efficiency. The project's versatility extends beyond Trading Corporation Bangladesh (TCB), enabling effective relief distribution in various sectors. Ultimately, the project streamlines delivery processes, making it a valuable asset for aiding those in need.**

I. Introduction

In our country, the Trading Corporation of Bangladesh (TCB) provides some special vehicles for selling food items (Rice, pulses, edible oil, etc.) at a cheap rate for people who cannot afford them. Sadly, we find a lot of issues there, like, in most cases, one person buys products that were available for more than 10/12 people. For these reasons, most of the needy people cannot even buy the product even though they wait in line for a very long time. Product stealing is another major issue here. We tried to solve this problem by using our "Smart Aid and Relief Rover" project. We can easily distribute food items, medicines, or any other products by using our multipurpose smart truck.

In this project When a person arrives at the specified location of the track, they must scan their ID. If the ID card is valid from the database, the front door will open. After delivering the product to a single person, the vending automation will begin inside the truck. A new package/lot will travel to the door side. Again, another person will check their ID in our RFID. If he/she has the validity to take the product, they can also take the product like earlier. However, in this system, we manage individual different packages. One important part of this project is, that it is not like that that we can only use it in TCB's truck, we can also use it in different transportation systems. When we need to send relief to needy people, we can use our project there too. We can easily distribute food items, medicines, or any other products by using our multipurpose smart truck. In that way, the delivery process will become smoothly oriented, and everyone in the specified area will get their products without any kind of hassle. We will also implement the theft detection process with a real-time feed with a camera. If we can implement this project successfully in every necessary sector, then delivering products will be an automated task where only a driver needs to take the truck to the destination, and all the processes will get automated. As we are mainly focusing on the delivery of food items, or the medical items (medicines, other necessary items, etc.) included in our relief items, we must ensure proper temperature so that food or medicines do not get spoiled. An automatic temperature control system will be implemented in case of excess temperature. Therefore, we are using a temperature sensor to keep track of the temperature conditions inside the truck's food storage. We are also getting a live status feed in our online web browser and mobile app. Therefore, we can monitor the condition remotely as well. We are also using another sensor to identify whether our food storage inside the truck is getting low or not. If our food supplies get low, an automated process will be implemented to ensure the resupply. For all the accessibility mentioned above, we are calling our project a "Smart Aid and Relief Rover".

II. Proposed Method

A. Block diagram of the overall system

We have implemented a hardware system along with the integration of IOT (Internet of Things) in our project and

the system is functioning with the software codes we have uploaded to our Arduino.

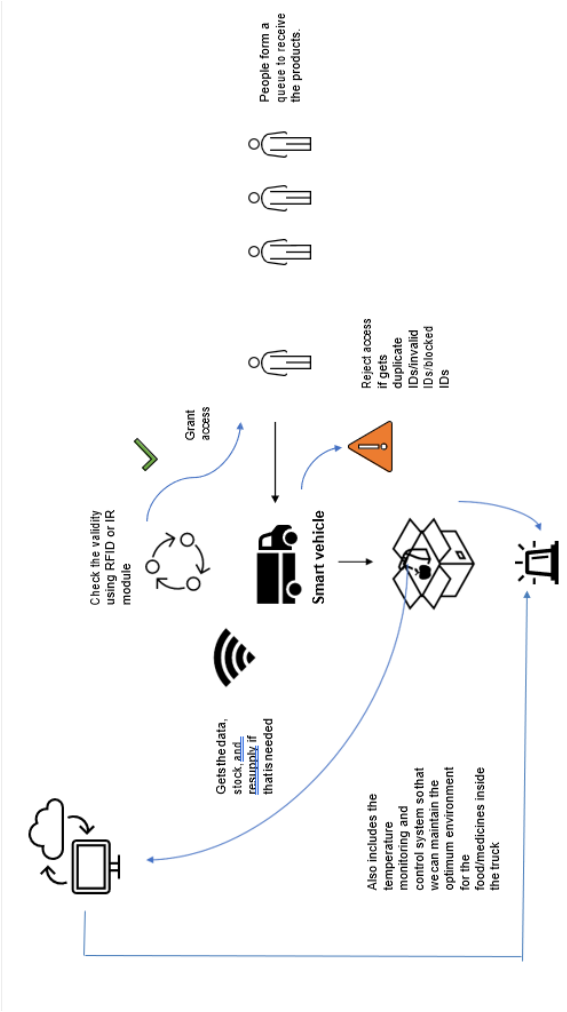

Fig. 1. Project Diagram

III. Implemented Hardware System -

A. List of the hardware and software Environment

1) Breadboard
A platform for prototyping electronic circuits without soldering, allowing components to be easily connected.

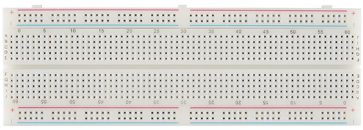

Fig. 2. Breadboard

2) Arduino Uno R3
Arduino is popular for various reasons. It is inexpensive, easy to program, open-source, reliable, and so on. After its creation, the microcontroller field has changed. From different types of Arduino boards, we've used Arduino UNO R3. It has 14 digital pins, 6 analog pins, an operating voltage of 3.3V and 5V, an input voltage of 7-20V with flash memory of 32 KB. It is a programmable circuit that can use to operate different devices with ease. CPU - Microchip AVR 8bit, memory - SRAM, clock speed - 16 MHz, weight - 25 g.

Fig. 3. Arduino Uno R3

3) Jumper Wire
Pre-made wires with connectors are used to establish connections between components on a breadboard.

Fig. 4. Jumper Wire

4) Ultrasonic Sensor
Measures distance by emitting ultrasonic waves and calculating the time it takes for the waves to bounce back.

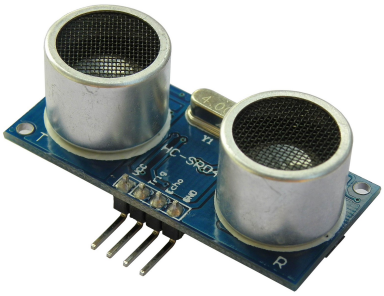

Fig. 5. Ultrasonic Sensor

5) DHT11
A sensor that measures temperature and humidity, providing digital output for environmental monitoring.
6) MIFARE Classic 1k RFID Sensor
Uses radio frequency identification technology to read and write data on compatible cards or tags.
7) ESP8266 NodeMCU Wifi module
A compact module that provides Wi-Fi connectivity, enabling IoT projects and data exchange.
8) Necessary resistors, wires, diodes, LED lights
Basic electronic components used to control current flow, create circuits, and indicate status.
9) Servo Motor

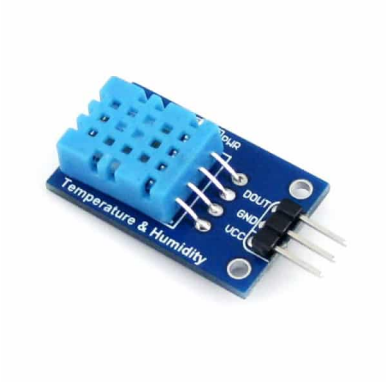

Fig. 6. DHT11

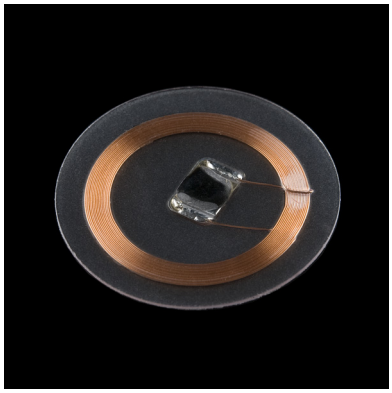

Fig. 7. MIFARE Classic 1k RFID Sensor

A motor that can be precisely controlled to rotate within a specific range, often used in robotics and automation.

10) DC Fan
A fan powered by direct current is commonly used for cooling purposes in electronic devices.
11) Gas Detecting Sensor
A sensor designed to detect specific gases in the environment, commonly used for safety in areas with potential gas leaks.

B. Figures of the implemented hardware system

The front side of our project is like below.

From the back, our project is like below which shows the product refill storage.

IV. Results

1) When an individual reaches the designated area on the route, they are required to scan their ID. If the ID is validated in the database, the front door will unlock. After delivering items to a single person, the automated vending process will initiate within the truck. A fresh package will move to the door. Another person will verify their ID using our RFID system. If they are authorized, they can retrieve items. This system effectively manages distinct individual packages.

Fig. 8. ESP8266 NodeMCU Wifi module

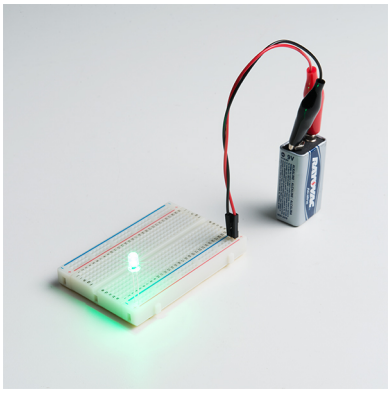

Fig. 9. Necessary resistors, wires, diodes, LED lights

2) To counter high temperatures, an automatic temperature control mechanism will be employed. Therefore, we are utilizing a temperature sensor to monitor conditions within the truck's food storage area.
3) Another sensor is used to determine whether the food storage level inside the truck is becoming insufficient. If supplies are running low, an automated procedure will ensure restocking.
4) Additionally, we receive real-time status updates through our online web browser and mobile application, enabling remote monitoring of conditions.

V. Conclusion

By introducing an advanced system of ID validation and automated vending, our project aims to transform essential goods distribution. Verified ID access ensures fairness, while individual package management streamlines the process. As we prioritize transparency and accessibility, our initiative represents equitable distribution's future.

Employing RFID and vending automation, we envision a seamless future for delivering vital items. The system's potential expansion to relief distribution and medical supplies promises a wider impact. Addressing distribution challenges underscores our commitment to aiding those in need.

Anticipating ongoing improvements, our project sets the stage for advancements in humanitarian assistance. This success signifies a sustainable and inclusive approach to providing crucial resources.

Fig. 10. Servo motor

Fig. 11. DC fan

REFERENCES

The entire project codebase is available on GitHub: smart-aid-and-relief-rover.
A short video demonstration is also available on YouTube.

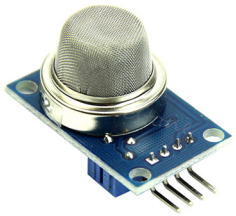

Fig. 12. Gas Detecting Sensor

Fig. 13. Front side of the project

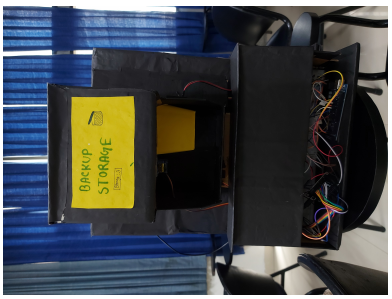

Fig. 14. Back side of the project