

Higher National Diploma in Software Engineering 24.2F
Statistics for Computing

Internet of Things

Medical Assistance Robot

Submitted by:

GROUP 16

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Introduction

The application of robotics within healthcare has recently emerged as a game-changer in dealing with the problems of looking after patients, especially senior citizens. This project describes the design and prototype development of an intelligent Medical Assistance Robot (MAR) with the objective of improving the quality and efficiency of caregiving services. This system is designed to perform autonomous monitoring of critical health indicators like heart rate and body temperature, as well as medication dispensing through a scheduled tray.

The robot can travel along a designated route, enabling it to autonomously approach and assist elderly patients at their locations. For ease of busting the workflow, a custom-built mobile application has also been designed to be used by caregivers. With the mobile app, the caregivers can view patient's vitals in real-time and are also provided with weekly reports, medication lists, scheduled reminders, and alerts.

Elderly patients have been broken into the project design considerations, where the aim lies in being able to provide them with the human touch partnered with technological support in order for them to receive more attentive, coordinated, and tailored medical care. With this endeavor, we intend to showcase the capability of intelligent medical systems not only to aid in the performance of routine medical tasks.

Problem Statement

1. Medication Non-Compliance by Elderly Patients

Elderly patients often miss or forget to take their medications on time, which may lead to critical health issues.

- ◆ *Supported by:* “A typical situation might involve an elderly person, recovering from a medical condition at home, linked to a combination of several connected services...”
(p.159)

2. Overburdened Caregivers

Many caregivers are unable to provide timely and personalized attention to every patient due to workload.

- ◆ *Supported by:* “Digital Health Advisors can... reduce the demand burden on clinicians.”
(p.161)

3. Lack of Real-Time Health Monitoring

Without real-time vitals tracking, early signs of medical emergencies may go unnoticed.

- ◆ *Supported by:* “Devices that constantly monitor health indicators... track real-time health data...” (Abstract, p.156)

4. Absence of Medical Record Tracking

Vital sign and medication histories are not easily accessible or stored in one unified system.

- ◆ *Reference:* “Wearables and mobile apps today support... symptom tracking and collaborative disease management...” (p.156)

5. Limited Automation in Elderly Care

Most caregiving systems still rely on manual efforts, with little use of automation or smart scheduling.

- ◆ *Reference:* “Real-time location services... reduce excess time spent.” (p.162)

6. Lack of Weekly Health Insights (e.g., Avg. Heart Rate)

Caregivers and doctors have no summarized data like average weekly heart rate to detect long-term patterns.

- ◆ *Reference:* “Sensors... now rapidly entering the general market... access to a wealth of information including pulse...” (p.158)

Proposed Solutions

1. Medical Assistance Robot (MAR)

A robot that autonomously moves to the patient at scheduled times, dispensing medication and monitoring vitals.

- ◆ *Supported by:* “Smartphone usage is increasing rapidly... mobile apps can improve communications between patients and doctors.” (p.162)

2. Automated Health Monitoring

The robot checks body temperature and heart rate using sensors, and alerts if abnormal.

- ◆ *Supported by:* “The Zio Patch measures heart rate and ECG and is... FDA-approved.” (p.158)

3. Scheduled Medication Dispensing

A pill tray system within the robot dispenses medicines at set times (morning, evening, night).

- ◆ *Supported by:* “Pharma IoT solutions... provide medication management, improving the patient outcomes...” (p.158)

4. Buzzer Alerts for Interaction

Sound notifications help elderly patients know when to take medication or when health readings are abnormal.

- ◆ *Supported by:* “...tele-alarms for the elderly: preliminary experiences in Mexico.” (Ref. 27, p.163)

5. Mobile App for Caregivers

Allows viewing real-time vitals, medication history, and pill schedules, with options to update and set reminders.

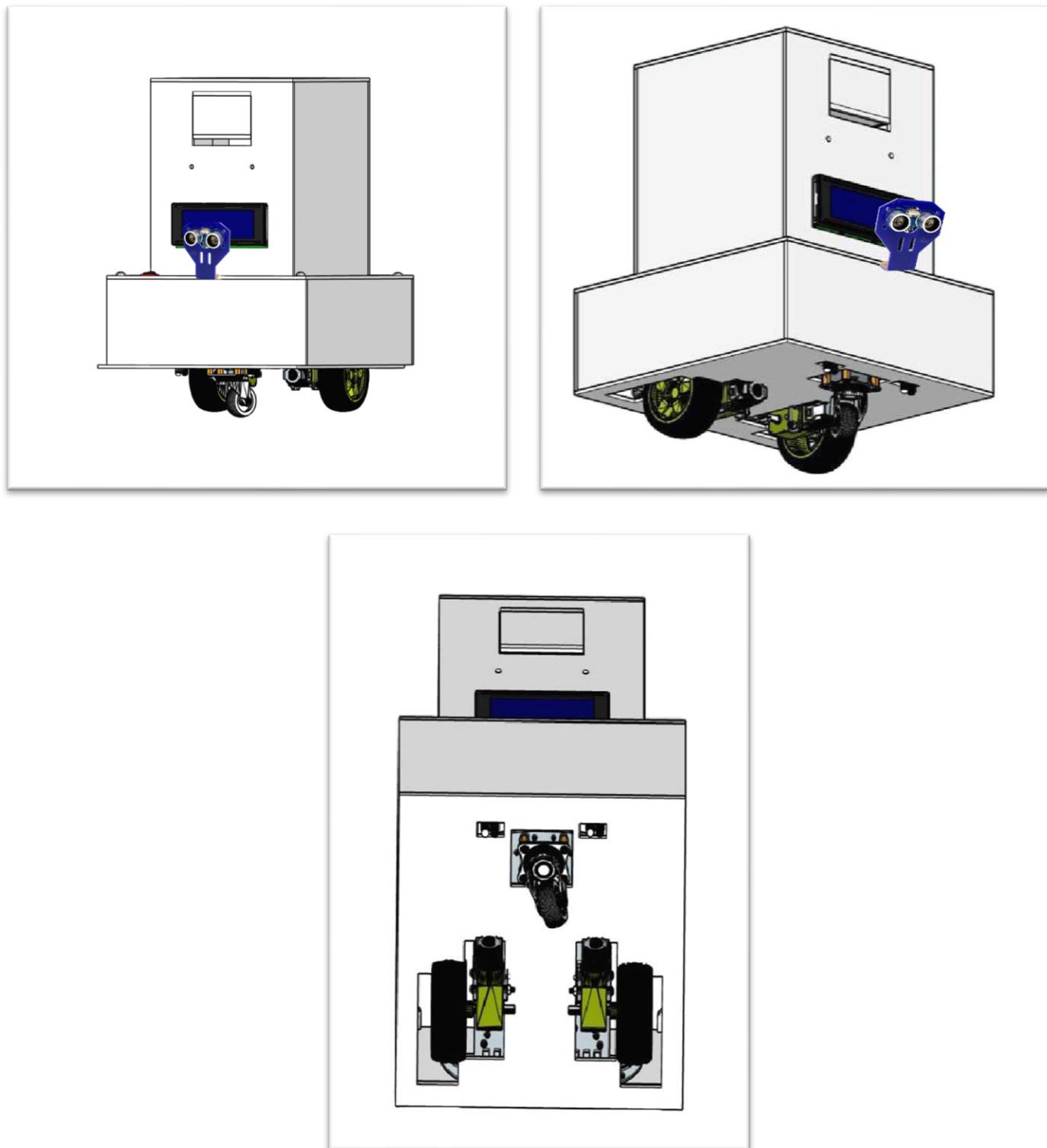
- ◆ *Reference:* “Mobile apps today support... care coordination.” (p.156)

6. Weekly Heart Rate Summary Feature

The system calculates and displays the average heart rate for each patient over the week for trend analysis.

- ◆ *Reference:* “Wearables... will soon have access to a wealth of information including... pulse, blood pressure...” (p.158)

System Design



Bill of Materials

Components	Quantity	Estimated Cost
Arduino Mega	1	Rs. 4350
Arduino Uno	2	Rs. 4200
Ultra sonic	2	Rs. 380
Servo Motors	3	Rs.1350
LM35 Temperature Sensor	1	Rs. 380
Pulse Sensor Amped (MD0199).	1	Rs. 490
DS3231 Precision Real time Clock Memory Module	1	Rs. 380
LCD Display: 20x4 Blue LCD Display (DM0004)	1	Rs. 880
I2C Module	1	Rs. 130
L298N Motor Driver Module	1	Rs. 460
3.7V Batteries	4	Rs.1400
Two Wheel Smart Car Chassis kit	1	Rs. 825
Piezoelectric buzzer.	2	Rs. 340
Jumper wires	-	Rs. 1500
Casing (plastic)	1	Rs. 3800
Switches and Buttons	5	Rs. 80
Soldering Iron (with lead)	1	Rs. 600

De Solder 0.8MM	1	Rs. 440
Hot Glue (with sticks)	1	Rs. 800
Screwdriver	2	Rs. 300
Tape	1	Rs. 200
Wi-Fi Module	1	Rs. 830
Cable ties	100	Rs. 60
Battery holder	1	Rs. 50
Velcro	2	Rs. 100
Arduino Battery connector	1	Rs. 50
Bread Board	1	Rs.250
Rechargeable 9v Battery	1	Rs. 890
MG90S Servo Motor	2	Rs. 900
Screws, Nuts, and Bolts	-	Rs. 200
Total Estimated Cost:		Rs. 22,845

Functionalities

1. Autonomous Movement

The robot follows a programmed path to visit the patient at the correct times without human control.

- ◆ *Supported by: "Real-time location services... doctors can easily track device locations..."* (p.162)

2. Pill Dispensing Mechanism

Pills are dispensed based on a set schedule with buzzer alerts to notify the patient.

- ◆ *Supported by: "...connected sensor wearables for Parkinson's... provide medication management..."* (p.158)

3. Vital Sign Monitoring

The robot reads heart rate and temperature. Alerts go off if values are abnormal.

- ◆ *Supported by: "Devices that constantly monitor health indicators..."* (p.156)

4. Mobile Application Features

Caregivers can:

- Monitor patient vitals and pill logs
- Set schedules and alerts
- Update medication lists

- ◆ *Supported by: "Mobile apps today support... care coordination." (p.156) and "...MyDario, SleepBot among others."* (p.159)

5. Return to Base Functionality

Once tasks are completed, the robot returns to its dock or charging station automatically.

- ◆ *Inferred from automation trends and IoT real-time routing: "Real-time location services... reduce excess time spent."* (p.162)

6. Weekly Average Heart Rate Summary

The system stores daily heart rate data and calculates weekly averages for trend monitoring.

- ◆ *Reference: "Consumers... will soon have access to... pulse, blood pressure... sleep patterns..."* (p.158)

Reference

- D. V. Dimitrov, "Medical Internet of Things and Big Data in Healthcare," *Healthcare Informatics Research*, vol. 22, no. 3, pp. 156–163, Jul. 2016. [Online]. Available: <https://doi.org/10.4258/hir.2016.22.3.156>