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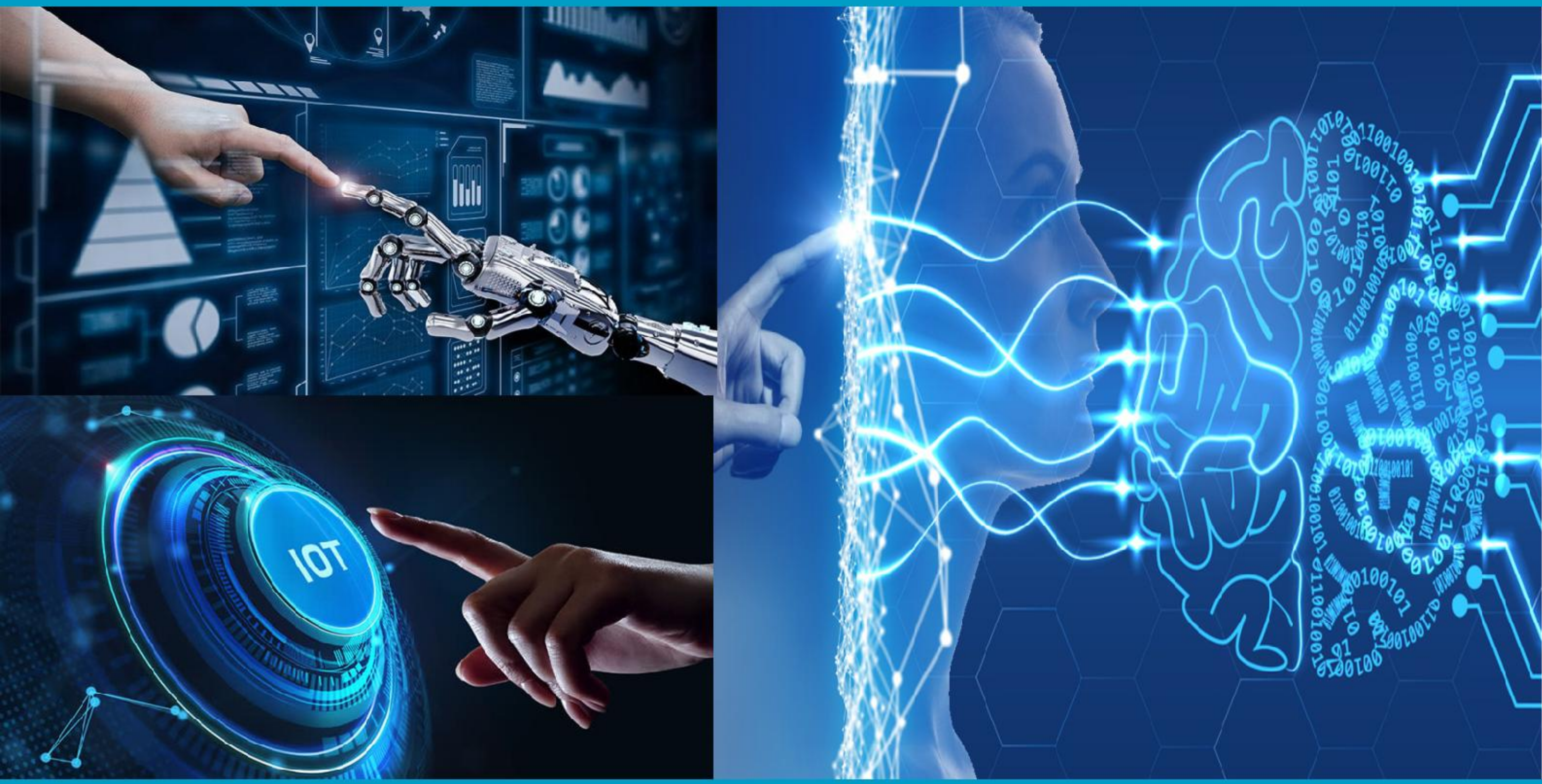

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Communication Assistance for the Elderly

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ABSTRACT: As the world's population continues to age, there is a growing interest in developing solutions for elderly living assistance. The Internet of Things is a new reality that is transforming everyday life and has the potential to revolutionize modern healthcare by enabling a more personalized, preventative, and collaborative form of care. To overcome this, the particular project proposes an IoT-ready solution for elderly living assistance that can monitor and record vital information of the elderly and also provides mechanisms for triggering alarms in emergency situations. The solution is low-power, low-cost, and wireless, making it suitable for use anywhere and by anyone. It is discreet and comfortable to wear, taking the form of a wristband. This project includes the designing of a GPS-based tracking system that can monitor the live location of elderly individuals and notify send notifications to caregivers through SMS messages. A Light Dependent Resistor (LDR) is installed to provide light assistance based on atmospheric intensity levels. Voice reminders are also included to prompt the elderly to take their medication, attend medical appointments, eat, and perform other necessary activities. A pulse monitor is employed to measure the individual's pulse rate and send notifications via Nodemcu if it deviates from the fixed range. To address this, the project includes communication systems that can identify the speech of the elderly and translate it into text format. These converted texts are then sent to their respective caregivers. Fall Detection is another feature of this solution that detects when the elderly individual falls and sends an alert message. All of these functions are controlled by a microcontroller, specifically the Arduino UNO.

KEYWORDS: Internet of things, Monitoring wristband, Arduino UNO, GPS, tracking system, light dependent resistor, light assistance, voice remainder, heartbeat sensor, Nodemcu, fall detection, microcontroller.

I.INTRODUCTION

The Internet of Things is transforming the world by connecting objects capable of generating and exchanging vast amounts of data. In the healthcare industry, the IoT promises to enable a more personalized, preventive, and collaborative form of care. The use of IoT-driven healthcare applications such as remote health monitoring, chronic diseases, private health and fitness, and ambient assisted living (AAL) can bring significant changes and impact to health care systems, especially in rural areas where emergency response teams are scarce.

Research has been conducted in IoT-driven healthcare applications, services, and prototypes, with the first steps rooted in wireless sensor networks (WSN). various systems have been put forward, such as a low-cost elderly assistive living system for private houses, an integrated system for patient monitoring, localization and tracking within nursing institutes, an IoT-aware smart hospital system (SHS), an IoT system for in-home health care services of elderly individuals with chronic cardiovascular and respiratory diseases, and some smart wearable solutions for AAL available on the market.

To contribute to better elderly living assistance, we developed a prototype model for elderly people that can monitor and collect important vital data, making it available to caretakers. The data is collected by a wristband integrated with speech recognition software and sent to the caretaker through SMS, triggering alerts in case of emergency situations such as falls or the absence of vital signs. The wristband is also designed to send text messages to the caretaker, displaying the words spoken by the elderly person on its LCD screen, and ensuring the caretaker is aware of what the elderly person has said. Our system includes sensors capable of monitoring heart rate and temperature and an accelerometer sensor for fall detection, and it was developed with low-power and low-cost requirements, making it suitable for use by everyone at the comfort of their homes.

II.LITERATURE REVIEW

In a paper by Kemper and Harden[1], The elderspeak, which involves speaking to older adults in an exaggerated and simplified manner, has been demostrated ineffective and potentially harmful in communication tasks. According to Kemper and Harden's paper, elderspeak may impair communication with elder person because the exaggerated prosody can distort important speech elements, and the use of short, choppy sentences can eliminate essential causal and temporal connections necessary for coherence and continuity. Moreover, the use of elderspeak can convey traits and characteristics about elder person, as it mimics the speech patterns of baby talk. This can create the perception that older adults are cognitively impaired and infantilized, reinforcing negative attitudes towards aging and aging individuals.

In a paper by James and Burke[2], conducted and asked different age groups general-knowledge questions that were designed to promote word retrieval failures. These questions were presented within a list of words, it were phonologically related to the word and it were unrelated. More joy fewer retrieval failures semantically related preceded by semantically related words it was not. it will suggest that phonological relatedness can facilitate word retrieval. When participants encountered make errors successfully retrieve the semantically related from memory.

In a paper by Charness[3], expansion of affordable, user-friendly communication technologies such as videophones and web-based conferencing is leading consumers into a golden age of communication. However, this golden age could be tarnished experienced difficulties make up a significant proportion of future users based on demographics alone. By incorporating these guidelines and principles, programmers can effectively make their communication technologies are inclusive and accessible to users of all ages. This can help to secure the golden age of communication envisioned by Charness is a reality to every end user, including older adults.

In a paper by Chaudhury et al[4], The authors emphasize the importance of using real-world data to train and test fall detection devices. Real-world precise information representations of actual falls, which can improve operational effectiveness detection systems. They also suggest that alternate design a standardized approach to evaluate the precise information fall detection devices to facilitate comparisons across studies. Overall, the findings of the more research devices, there a need for further research and development to performance the reliability and accuracy of these devices. The authors note that incorporating real-world data in the critical step.

In a paper by Ryan, Giles, Bartolucci, and Henwood[5], identified two communication patterns that affect older adults: under accommodations and overaccommodations. Under accommodations occur when aging's impact on speaking and listening is ignored, leading to comprehension failure and possible exploitation. Over accommodations may lead to negative self-assessments, contributing to sociocognitive decline. Therefore, it's essential to strike a balance in communication with older adults.

In a paper by Rowe and Kahn[6], emphasized the crucial role of social interaction in the people of older adults. They found elder person has live longer react favorably healthcare interventions when they have strong closely supported care providers. This demonstrates the significant impact of social interaction on the wellness older adults. The power of social support extends beyond just physical health benefits, as it also contributes to improved mental health outcomes, greater happiness, and increased overall life satisfaction. Given these findings, it is clear that social interaction is a fundamental aspect of successful aging prioritized in healthcare settings and community programs aimed at improving people of older adults.

In a paper by Williams et al[7], conducted a study that showed a significant reduction in the use of elderspeak by nursing assistants after undergoing communication training. The study also revealed an boost adoption communication that was rated as more respectful, less controlling, and equally caring. These findings are important as elderspeak linked the negative result like lower self-esteem, disempowerment, and even aggression in older adults. The study highlights the medical staff communication working with older adults, as it has positive effect on excellence care provided and aid in overall well-being of older adults.

In a paper by Caporael's paper[8], discusses a particular style of speech known as "infantilizing speech," which is often used when speaking to older adults or individuals with disabilities. This type of speech can resemble baby talk in its slower pace, exaggerated intonation, high pitch, and increased repetition. Additionally, the vocabulary and grammar used in infantilizing speech are often simplified compared to typical adult speech. This type of speech is often viewed as disrespectful and can contribute to feelings of helplessness and decreased self-esteem in older adults or individuals with disabilities. It will significantly recognize and avoid the act of infantilizing speech when communicating with these populations.

In a paper by Caporael and Culbertston,1986; Henwood and Giles,1985[9], the caregivers may assume that older adults prefer to be spoken to in elderspeak. Elderly individuals institutional settings and those receiving home care services report that as many as 40% of their caregivers use language that they perceive as condescending and demeaning. This indicates a communication gap between caregivers and older adults, highlighting the importance of understanding the negative effects of elderspeak and promoting respectful and appropriate communication in healthcare settings.

In a paper by Kemper and Harden, 1999 and Ryan, Bourhis, and Knots, 1991[10], it will be found that elder person who receive elderspeak perceive it as patronizing and implying incompetence. This may lead to lowered self-esteem, depression, withdrawal from social interactions, and even assumption of dependent behavior consistent with their own stereotypes of elderly individuals. The use of elderspeak may reinforce bias aging and reinforce power imbalances between the speaker and the older adult, leading to further marginalization and social isolation.

III. PROPOSED METHODOLOGY

Step 1: Use the Arduino ATmega 328P IC as the main controller:

- Initialize the Arduino ATmega 328P IC
- Establish communication protocols with all connected devices
- Receive and transmit information to and from all connected devices
- The connectivity that will confirm the functioning simultaneously

Step 2: Use a GPS module to locate the person's latitude and longitude:

- Initialize the GPS module
- Retrieve latitude and longitude data from the GPS module
- Store the latitude and longitude data

Step 3: Send the person's latitude and longitude to the registered user via SMS using NodeMCU:

- Initialize NodeMCU
- Send latitude and longitude data to the registered user via SMS using NodeMCU

Step 4: Control an LED based on the value of the LDR:

- Initialize the LDR
- Read the value of the LDR
- Determine the appropriate LED state derived the LDR value
- Operate the LED accordingly

Step 5: Measure the person's heart rate using a pulse monitor:

- Initialize the pulse monitor
- Read the person's heart rate at regular intervals

Step 6: Convert the speech of the elderly into text format and forward it to their respective caregivers:

- Initialize the speech recognition module
- Record the speech of the elderly

- Convert the speech into text format
- Forward the text to the appropriate caregiver

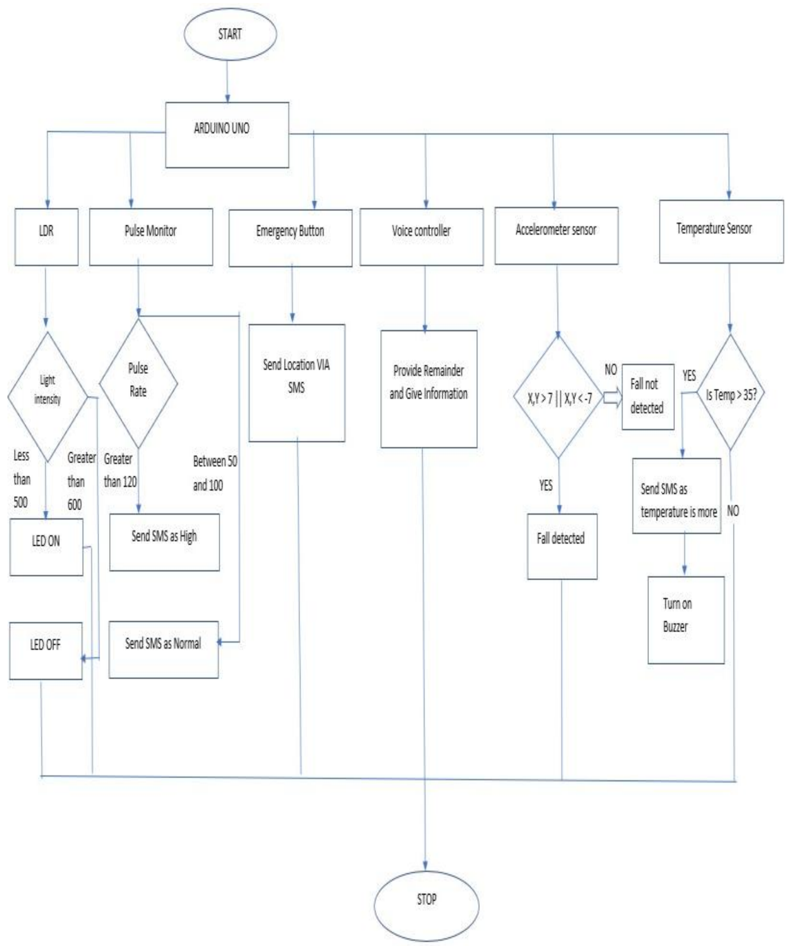

Fig-1: Flow Chart

IV. SYSTEM DESIGN

Figure 2 represent the visual schematic of proposed system. Alternative representation has seven main components: Arduino UNO, HC-05 Bluetooth, Pulse Monitor, LM35 Temperature Sensor , LDR (Light-dependent resistor), ADXL345 Accelerometer sensor, LCD (Light crystal display), NodeMCU and smart phone with voice control application.

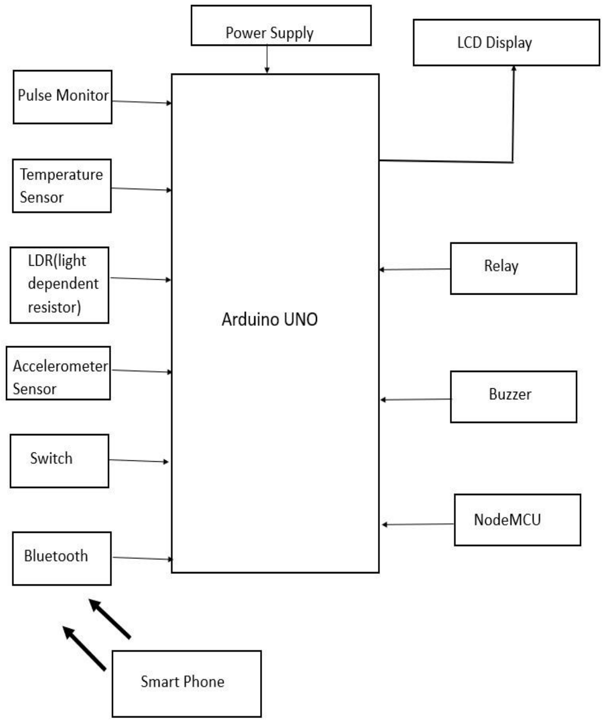

Fig 2: Block diagram of the system

V. WORKING PRINCIPLE

The block diagram has been followed to establish all the necessary connections for this project.

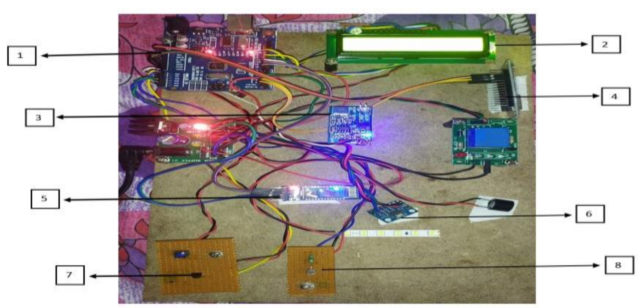

Fig 3: Top view of the prototype system

The above Fig 3 shows that number 1 refers to the **Arduino Uno**, it is a microcontroller board that is based on the ATmega328P microcontroller chip. It has 14 digital I/O pins and 6 analog input pins, and it also supports communication through serial protocols.

Number 2 is the **LCD display**, An LCD display 16x2 is a type of alphanumeric display that can show up to 16 characters per line, and there are two lines in total. In our project, the LCD display has been connected to the Arduino Uno board in the following manner: the D4, D5, D6, and D7 pins of the display are connected to digital pins 8, 9, 10, and 11 on the

Arduino board respectively, while the EN and RS pins of the LCD display have been assigned to digital pins 12 and 13 on the Arduino Uno board.

Number 3 is a **pulse monitor** is a sensor that measures the pulse rate of a person, and in our project, it has been connected to the Arduino Uno board through the analog pin A0.

Number 4 and 5 is **NodeMCU** and **Bluetooth**. In our project, we utilized Bluetooth and NodeMCU for serial communication, using the UART protocol, and assigned the RX and TX pins on the Arduino board for signal reception and transmission. The NodeMCU was connected to the digital pins 0 and 1 of the Arduino board to function as RX and TX. To make digital pins 6 and 7 work as RX and TX, we utilized the serial software library.

Number 6 is the **ADXL345 Accelerometer sensor**. The ADXL345 accelerometer sensor is a device that measures acceleration in three axes, allowing for the detection of movement and orientation changes. In our project, it is used for fall detection where the SDA and SCL pins of the ADXL345 sensor have been connected to the analog pins A4 and A5 on the Arduino board, respectively.

Number 7 is the **LM35 temperature sensor** is a precision device that can measure temperature with high accuracy and convert it into an analog voltage output. In our project, we have connected the LM35 temperature sensor to the analog pin A1 of the Arduino board.

Number 8 is **LDR** stands for Light-Dependent Resistor, it is a sensor that changes its resistance based on the amount of light it receives. In our project, we have connected the LDR to the analog pin A2 of the Arduino board.

Once all the connections have been established, the next step involves pairing the smartphone with the HC-05 Bluetooth module to enable wireless communication.

Once all the necessary connections have been made, the system is ready for use. The elderly person can activate the system by simply pressing the microphone icon on the app and issuing voice commands. The system uses voice recognition technology to convert the commands into text format, which is then sent to the Arduino board over Bluetooth. The commands are displayed on the LCD screen, and an SMS is sent to the designated caretaker.

For example, if the elderly person says "I need water", the app will recognize the command and transfer it into the Bluetooth module. The pulse monitor will measure the heart rate, while the temperature sensor will sense the body temperature of the elderly person. Both the heart rate and body temperature measurements will be displayed on the LCD screen and sent via SMS to the caretaker.

In case of an emergency, the system includes a button that the elderly person can press to immediately send an SMS to the nearest healthcare services with their GPS location.

The Light-dependent resistor (LDR) is to detect whether it is daytime or night-time. When it is night-time, the system will turn on the LED to provide the elderly person with adequate lighting.

Finally, the ADXL345 accelerometer sensor is used to detect falls. If a fall is detected, the system will turn on the buzzer and send an SMS to the caretaker.

VI. RESULT

The final result of this project is a system that uses various sensors and technologies to provide assistance to elderly people. It allows the elderly person to issue voice commands through a smartphone app that is converted into text and sent to the Arduino board over Bluetooth. The commands are then displayed on the LCD screen and sent to a designated caretaker via SMS. The system also includes a pulse monitor to measure heart rate and a temperature sensor to measure body temperature.

In case of an emergency, the system has a button that the elderly person can press to send an SMS to the nearest healthcare services with their GPS location. Additionally, the Light-dependent resistor (LDR) detects whether it is daytime or nighttime and turns on the LED when it is dark to provide adequate lighting for the elderly person.

Finally, the ADXL345 accelerometer sensor is used to detect falls. If a fall is detected, the system turns on the buzzer and sends an SMS to the caretaker. Overall, this project provides a valuable tool for elderly people who may need assistance in their daily lives and helps to ensure their safety and well-being.

Fig 4: Text displayed on LCD

VII. CONCLUSION

We have developed a voice-based elder care system and successfully created a prototype model. Our prototype model has demonstrated satisfactory performance. In case additional appliances are needed to cater to the specific demands or needs of the elderly, they can be easily incorporated into the existing system. We understand the challenges faced by many families in providing care to their elderly members. Therefore, we have designed a user-friendly device that can be easily transported and used to take care of elderly individuals.

Our device offers comprehensive care solutions to elderly people, which prevents them from feeling isolated or depressed. By using our device, elderly individuals can still feel a sense of community and social life, which can provide them with the energy and empowerment they need. The transition to elder care is a challenging and emotional period for both families and the elderly themselves. Our device seeks to alleviate many difficulties and create a more supportive and caring environment for everyone involved.

VIII.FUTURE SCOPE

The future scope of this system could include the integration of more advanced sensors and technologies to improve the accuracy and functionality of the system. For example, the addition of a camera module could provide a visual feed to the caretaker and aid in identifying potential hazards or situations requiring assistance. The incorporation of machine learning algorithms could also enhance the system's voice recognition capabilities, allowing for more accurate and natural language processing. Additionally, the system could be integrated with other healthcare devices to track vital signs, medication schedules, and other health-related information. The system could also be expanded to include remote monitoring and telemedicine capabilities, allowing healthcare providers to monitor the elderly person's health and provide medical assistance as needed. Finally, the system could be further developed to support a broader range of users, such as those with disabilities or chronic illnesses, to provide more personalized and comprehensive care.

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