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Socio Connect: Bridging Citizens and Government Initiatives with Intelligent Systems



Abstract: - The digital divide in India presents significant barriers for economically disadvantaged and illiterate citizens, obstructing their access to essential government services and information. Despite various efforts to bridge this divide, such as the UMANG (Unified Mobile Application for New-age Governance) app, which consolidates multiple government services into a single platform, these solutions primarily cater to literate users with access to modern technology. The UMANG app, while comprehensive, remains inaccessible to those who are illiterate, semi-literate, or lack advanced devices [1][2]. Research highlights that a large segment of the Indian population continues to rely on basic mobile phones, which limits their ability to access digital services [3][4]. Our proposed solution, SOCIO CONNECT, addresses this gap by utilizing basic mobile technology to deliver government services through voice calls, making it accessible to both literate and illiterate users. By integrating voice-based interaction with government schemes, SOCIO CONNECT aims to enhance inclusivity and empower marginalized citizens who are otherwise excluded from digital solutions [5][6][7].

Keywords: Digital Inclusion, Government Schemes, Voice-Based Interaction, Illiteracy, Socio-Economic Disparities, Basic Mobile Technology, UMANG Integration, Artificial Intelligence, Natural Language Processing, Whisper AI.

I. INTRODUCTION

India's vast and diverse population includes a significant segment facing challenges related to literacy. Illiteracy and limited literacy skills hinder millions of citizens from accessing crucial information about government schemes and welfare programs designed to support their development. This gap in awareness and accessibility exacerbates socio-economic disparities, leaving many in disadvantaged communities unable to avail themselves of the benefits intended for their well-being and advancement [1][2].

Despite the government's efforts to disseminate information through various channels, the complexity of accessing and understanding details often leaves illiterate or semi-literate citizens in the dark. Traditional methods of information dissemination have proven insufficient to bridge this gap, highlighting the need for a more inclusive and user-friendly approach [3][4].

In response to this critical issue, we introduce "SOCIO CONNECT: BRIDGING CITIZENS AND GOVERNMENT INITIATIVES WITH INTELLIGENT SYSTEMS." SOCIOCONNECT is an innovative platform that leverages advanced technologies such as voice recognition, artificial intelligence, and natural language processing to provide an accessible interface for all citizens. By integrating with the UMANG API, SOCIO CONNECT offers up-to-date, personalized information on central and state government schemes, ensuring that even those with limited literacy skills can stay informed and benefit from available resources [5][6].

This research paper explores the development and implementation of SOCIOCONNECT, emphasizing its potential to transform the way citizens interact with government initiatives. We aim to demonstrate that intelligent systems can play a pivotal role in promoting social inclusion, empowering individuals, and fostering a more equitable society. Through SOCIO CONNECT, we envision a future where every citizen, regardless of their literacy level, has the knowledge and tools needed to access the support necessary for their success [7][8].

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II. LITERATURE SURVEY

The digital divide in India poses significant challenges for many citizens, especially those from economically disadvantaged and illiterate backgrounds, in accessing essential government services and information. Studies have emphasized the socio-economic impacts of this divide, particularly in rural and underserved urban areas [1][2]. Access to information is a fundamental right that can significantly enhance citizens' quality of life and enable them to benefit from various government schemes. However, the literacy gap continues to obstruct millions from leveraging these schemes intended to support their welfare and development.

One notable initiative aimed at bridging this gap is the UMANG (Unified Mobile Application for New-age Governance) app. UMANG serves as a comprehensive platform that integrates various government services and schemes into a single, user-friendly application. It provides users with access to information, enables them to apply for benefits, and keeps them updated on government initiatives [3]. Despite its extensive features, the UMANG app primarily caters to literate users who possess basic computer or smartphone knowledge. This limitation creates a significant barrier for illiterate or semi-literate individuals, as well as for those lacking access to necessary technology [4].

Research indicates that a substantial portion of India's population relies on basic mobile phones with limited functionality. According to the Telecom Regulatory Authority of India (TRAI), many users in the country use feature phones that lack the advanced capabilities of smartphones. This demographic is often excluded from the digital revolution due to the limitations of their devices and their inability to navigate complex applications [5][6].

While existing solutions have made strides, they often fail to address the critical issue of accessibility for illiterate and economically disadvantaged citizens. This gap underscores the need for alternative approaches that leverage basic mobile technology to promote inclusivity. Many citizens may lack the financial means to afford laptops or smartphones and may also struggle with literacy skills required to use such applications effectively [7][8]. Thus, a more inclusive solution is essential to ensure that all individuals, regardless of their literacy level or technological resources, can access and benefit from government schemes and services.

III. METHODOLOGY

System Architecture

The architecture of the SOCIOCONNECT system is designed to ensure accessibility, scalability, and user-friendliness. The system leverages various technologies and methodologies to provide seamless integration and interaction for users.

Modules

1. *Database with Scheme Information:*

- MongoDB is used to store detailed information about various government schemes. The database is regularly updated to reflect new schemes and changes to existing ones.

2. *Speech-to-Text (STT):*

- The STT module, powered by OpenAI Whisper-1, accurately converts user speech into text, allowing for effective processing and understanding of user queries.

3. *Text-to-Speech (TTS):*

- The TTS module, powered by OpenAI tts-1 converts textual responses into speech, ensuring that users can understand the information regardless of their literacy level.

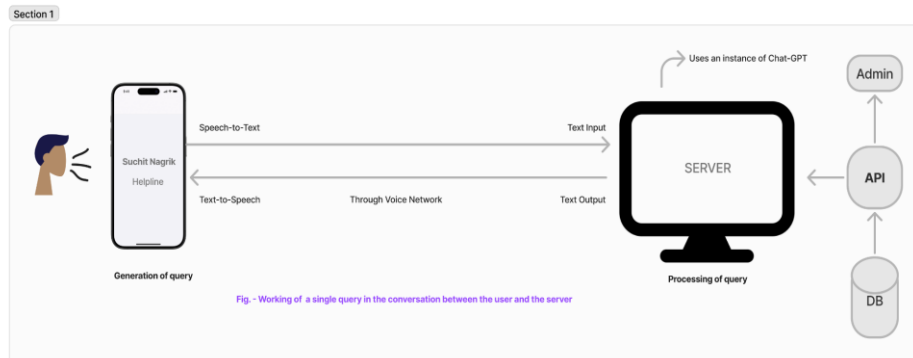
4. *Government Schemes Integration:*

- Integration with the UMANG app to ensure comprehensive and up-to-date information. Data is currently manually extracted from the UMANG website due to API unavailability.

Technologies Used

1. **Programming Language:** Python, ExpressJS

2. **Database:** MongoDB
3. **Speech-to-Text:** Whisper-1
4. **Text-to-Speech:** OpenAI tts-1
5. **Translation:** Google Translate
6. **Keywords:** gpt-3.5-turbo-0613



Development Process

The development process of SOCIO CONNECT follows the V-shaped model, which ensures thorough validation and verification at each stage. The V-shaped model was chosen for its emphasis on early detection of defects and its structured approach to software development.

1. Requirements Analysis:

- a. User Needs: Access to comprehensive, up-to-date information about government schemes.
- b. System Functionalities:
 - i. Accurate STT and TTS capabilities.
 - ii. Regularly updated database of schemes.
 - iii. Integration with UMANG app data.

2. System Design:

- a. Frontend: User interface for interaction.
- b. Backend: API for processing user requests.
- c. Database: MongoDB for storing schemes.
- d. Speech Processing: OpenAI Whisper-1 for STT, OpenAI tts-1 for TTS.
- e. Integration: Module for UMANG app data.

3. Module Design:

- a. STT Module: Use OpenAI Whisper-1 to convert speech to text.
- b. TTS Module: Use OpenAI tts-1 to convert text to speech.
- c. Database Module: Store and update scheme information in MongoDB.
- d. Integration Module: Extract data from UMANG website and update MongoDB.

4. Coding:

a. STT Module:

```
FUNCTION STT(audio_file_path, user_language):
```

```

// Open the audio file in binary read mode
OPEN audio_file_path AS audio_file IN READ BINARY MODE

// Use the client to create a transcription from the audio file
transcript <- client.audio.transcriptions.create(
  model = environment variable "STT_MODEL",
  file = audio_file,
  language = user_language
)

// Return the transcribed text from the transcript object
RETURN transcript.text

```

b. TTS Module:

```

FUNCTION TTS(translated_text):
  // Use the client to create a speech synthesis response with streaming
  response <- client.audio.speech.with_streaming_response.create(
    model = environment variable "TTS_MODEL",
    voice = "alloy",
    input = translated_text
  )

  // Stream the synthesized audio response to the output file
  response.stream_to_file(output_file)

```

c. Database Module:

```

FUNCTION getSchemesFromKeywords(tags, state):
  collection <- MongoDB collection "schemes"

  // Create case-insensitive regex patterns for tags and state
  tagsInNameRegex <- array of regex patterns for tags to match in schemeName
  tagsInTagsRegex <- array of regex patterns for tags to match in tags field
  stateRegex <- regex pattern for state (if provided)

  // Define filters to search for schemes
  filters <- array of filter objects combining tags and state conditions

  // Try each filter and return the first matching result
  FOR EACH filter IN filters:
    data <- query collection using filter and projection
    IF data IS NOT EMPTY:
      RETURN data

  // If no exact matches, find schemes with the most matching tags
  pipelineForMostTags <- aggregation pipeline to:

```

- Add a field 'matchedTags' containing tags that match the input tags
- Add a field 'matchCount' with the number of matched tags
- Filter documents with at least one match and matching state (if provided)
- Sort by matchCount descending
- Group by matchCount and keep only the group with the highest matchCount
- Unwind and replace the root with each document
- Project only the required fields

```
data <- execute aggregation pipeline
```

```
RETURN data IF NOT EMPTY, ELSE null
```

5. *Unit Testing:*

```
FUNCTION test:
```

```
greeting_and_language_select()
```

```
openingQuery()
```

```
REPEAT FOREVER:
```

```
input <- record_translate_text()
```

```
IF isFarewell(input) IS TRUE:
```

```
EXIT LOOP
```

```
output <- extract_keyword_and_get_scheme(input)
```

```
translate_text_play_audio(output)
```

```
elseQuery()
```

```
// Output
```

```
Hello from the pygame community. https://www.pygame.org/contribute.html
```

```
SN: Hello, I'm here to help you with schemes. Select your language: Hindi, Tamil, Telugu, or English?
```

```
* recording
```

```
* done recording
```

```
User: English
```

```
SN: Hello. How can I help you with?
```

```
* recording
```

```
* done recording
```

```
User: handicraft societies in Puducherry.
```

```
Keywords: {'tags': ['handicraft', 'society'], 'state': 'Puducherry'}
```

```
SN: "Grant To Handicrafts Societies" Component of the "Development of Handicrafts" Scheme: "Grant To Handicrafts Societies" by the Department of Industries and Commerce, UT of Puducherry aims to encourage the creation of Handicrafts Societies to enhance coordination and skill among craftspeople. Grants are provided to registered societies for organizing or participating in exhibitions.
```

```
SN: Anything else ?
```

* recording
 * done recording
 User: Good bye.
 SN: Good bye.

6. *System Testing:*

a. The complete system is tested to ensure it meets all requirements and performs well under various conditions.

7. *XR User Acceptance Testing (UAT):*

a. The system is tested by actual users to ensure it meets their needs and is user-friendly.

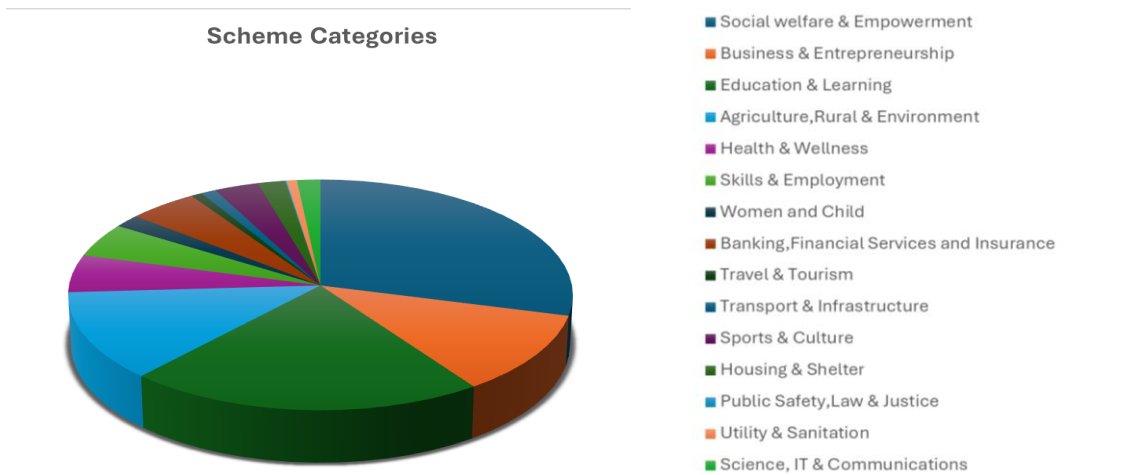
8. *Deployment:*

a. The system is deployed for use by the target audience.

9. *Maintenance:*

a. Ongoing maintenance to update the database, fix bugs, and improve system performance.

IV. RESULTS ANALYSIS



V. CONCLUSION

Summary

SOCIO CONNECT was conceived with the primary objective of bridging the gap between government initiatives and the economically weaker, often illiterate, sections of Indian society. This research aimed to address the critical issue of accessibility to welfare schemes, leveraging advanced technologies to create an inclusive, voice-based system. Our findings demonstrate that SOCIO CONNECT successfully provides an effective, user-friendly interface for illiterate and semi-literate users, ensuring they can access vital information about government schemes through basic mobile phones. This system not only increases awareness but also empowers users by enhancing their engagement with government initiatives.

Future Work

While SOCIOCONNECT has shown promising results, there are several areas for potential improvement and future research:

1. **Integration with UMANG API:** Securing and integrating the UMANG API will allow for real-time updates and a more comprehensive database of government schemes, further enhancing the system's utility.
2. **Enhanced User Experience:** Continuously improving the speech recognition accuracy and response quality, particularly in regional languages, to ensure seamless user interaction.

3. **Expanded Outreach:** Developing strategies for broader dissemination and adoption, particularly in remote and underserved areas.
4. **Additional Features:** Incorporating features such as personalized recommendations based on user profiles and feedback mechanisms to continuously improve the service.

Impact

SOCIO CONNECT is expected to have a significant impact on citizen engagement and government transparency. By providing an accessible platform for all citizens, regardless of their literacy level or economic status, SOCIO CONNECT fosters greater awareness and utilization of government schemes. This increased engagement not only benefits the individuals directly by ensuring they receive the support they are entitled to but also enhances overall government transparency and accountability. By bridging the information gap, SOCIO CONNECT promotes social equity and helps in building a more inclusive society where every citizen can actively participate in and benefit from government initiatives.

REFERENCES

- [1] Wiley, K., & Goulding, A. (2023). The conceptualization of digital inclusion in government policy: A qualitative content analysis. In: Sserwanga, I., et al. *Information for a Better World: Normality, Virtuality, Physicality, Inclusivity*. iConference 2023. Lecture Notes in Computer Science, vol 13972. Springer, Cham. https://doi.org/10.1007/978-3-031-28032-0_40
- [2] Latupeirissa, J. J. P., Dewi, N. L. Y., Prayana, I. K. R., Srikandi, M. B., Ramadiansyah, S. A., & Pramana, I. B. G. A. Y. (2024). Transforming public service delivery: A comprehensive review of digitization initiatives. *Sustainability*, 16(7), 2818. <https://doi.org/10.3390/su16072818>
- [3] Idzi, F. M., & Gomes, R. C. (2022). Digital governance: Government strategies that impact public services. *GPPG*, 2, 427–452. <https://doi.org/10.1007/s43508-022-00055-w>
- [4] Sarker, I. H. (2022). AI-based modeling: Techniques, applications and research issues towards automation, intelligent and smart systems. *SN Computer Science*, 3, 158. <https://doi.org/10.1007/s42979-022-01043-x>
- [5] Nagdewani, S., & Jain, A. (2020). A review on methods for speech-to-text and text-to-speech conversion. *International Journal of Scientific & Technology Research*, 9(3), 5-10.
- [6] Spiller, T. R., Rabe, F., Ben-Zion, Z., Korem, N., Burrer, A., Homan, P., & Duek, O. (2023). Efficient and accurate transcription in mental health research: A tutorial on using Whisper AI for audio file transcription. *PsyArXiv Preprints*. <https://doi.org/10.31219/osf.io/9fue8>
- [7] Sharp, M. (2024). Revisiting the measurement of digital inclusion. *The World Bank Research Observer*, 39(2). <https://doi.org/10.1093/wbro/lkad007>
- [8] Y. Zhenzhen, M. Abilmit and A. Hamdulla, "Summary of Research on Whispered Speech Recognition Technology," 2022 International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS), Hengyang, China, 2022, pp. 1245-1249, doi: 10.1109/ICITBS55627.2022.00265.
- [9] Gopichand, G., Sarath, T., Dumka, A., Goyal, H. R., Singh, R., Gehlot, A., ... & Twala, B. (2024). Use of IoT sensor devices for efficient management of healthcare systems: a review. *Discover Internet of Things*, 4(1), 8.
- [10] Ameer, J. S., Senthilnathan, P., Ilayaraja, V., & Gopichand, G. (2023). Exploring the associations between Diabetes Mellitus and Diabetic Retinopathy: Prevention and Management by focus on Machine Learning Technique. *Salud, Ciencia y Tecnología*, 3, 556-556.
- [11] Gopichand, G., Sampath, R., & Ramesh, L. K. (2023). Deep learning network for road image analysis with traffic and accident detection. *ARPN journal of engineering and applied sciences*, 18(20), 2304-2310.
- [12] Gopichand, G., Ramesh, A., Tholappa, V., Sridara Pandian, G. (2023). Depression Detection Using Deep Learning. In: Bhateja, V., Carroll, F., Tavares, J.M.R.S., Sengar, S.S., Peer, P. (eds) *Intelligent Data Engineering and Analytics. FICTA 2023. Smart Innovation, Systems and Technologies*, vol 371. Springer, Singapore. https://doi.org/10.1007/978-981-99-6706-3_20
- [13] Rout, S., Adabala, M.S., Gopichand, G. (2023). Solutions to Diffusion Equations Using Neural Networks. In: Sharma, S., Subudhi, B., Sahu, U.K. (eds) *Intelligent Control, Robotics, and Industrial Automation. RCAAI 2022. Lecture Notes in Electrical Engineering*, vol 1066. Springer, Singapore. https://doi.org/10.1007/978-981-99-4634-1_69
- [14] Gopichand, G., Vijaya Krishna, A., Ravi Prakash Reddy, I., Vandana, D., Ramana, K., Purshotham, P. (2023). High-Resolution Image Inpainting Using Generative Adversarial Networks. In: Kumar, A., Ghinea, G., Merugu, S. (eds) *Proceedings of the 2nd International Conference on Cognitive and Intelligent Computing. ICCIC 2022. Cognitive Science and Technology*. Springer, Singapore. https://doi.org/10.1007/978-981-99-2742-5_73

- [15] Chalapathi, M. M. V., Krishna, A. V., Gopichand, G., Ramana, K., Bharathi, V. C., & Sharma, N. (2023). Prediction of Seed Germination Quality Utilizing Ensemble-Based Precision Forming. *International Journal of Intelligent Engineering & Systems*, 16(4).
- [16] Jyothsna, V., Prasad, M., GopiChand, G., & Bhavani, D. D. (2022). DLMHS: Flow-based intrusion detection system using deep learning neural network and meta-heuristic scale. *INTERNATIONAL JOURNAL OF COMMUNICATION SYSTEMS*.
- [17] Reddy, N. M., Ramesh, G., Kasturi, S. B., Sharmila, D., Gopichand, G., & Robinson, L. T. (2022). Secure data storage and retrieval system using hybridization of orthogonal knowledge swarm optimization and oblique cryptography algorithm in cloud. *Applied Nanoscience*, 1-13.
- [18] A. Vijayakrishna, G. G, M. D. Ansari and G. Suryanarayana, "IOT Based Smart Agriculture Using LIFI," 2022 5th International Conference on Multimedia, Signal Processing and Communication Technologies (IMPACT), Aligarh, India, 2022, pp. 1-7, doi: 10.1109/IMPACT55510.2022.10029255.
- [19] Gopichand G, Vijayakumar, Pasupuleti, N.S. (2021). On-Road Crime Detection Using Artificial Intelligence. In: Favorskaya, M.N., Mekhilef, S., Pandey, R.K., Singh, N. (eds) *Innovations in Electrical and Electronic Engineering. Lecture Notes in Electrical Engineering*, vol 661. Springer, Singapore. https://doi.org/10.1007/978-981-15-4692-1_32
- [20] Gopichand, G., Sola, K., Reddy, C. B. S., Rakesh Kumar, M. V., & Vardhan, H. Vocabulary Mismatch Avoidance Techniques., *International Journal of Scientific and Technology Research*, 2020,9(4), pp. 2585–2594
- [21] Ginnela, Gopichand., & Saravanaguru, R. K. (2020). Collaborative packet dropping intrusion detection in MANETs. *Recent Advances in Computer Science and Communications (Formerly: Recent Patents on Computer Science)*, 13(6), 1269-1277.
- [22] Gopichand, G., Jain, K., & Dev, S. K. (2019). Research on e-healthcare security evaluation in cloud- based system. *International Journal of Recent Technology and Engineering*, 8(2 Special Issue 11), pp. 3050-3053
- [23] Gopichand, G., Vamsi, K.S.V., Subhash Reddy, Y.S., ...Chand, K.S.P., Saiteja, G. (2019). A hybrid scheme in cloud computing for secure sharing of data in the cloud, *International Journal of Recent Technology and Engineering*,
- [24] Gopichand, G., Sailaja, G., Vinod Kumar, V. N., & Samatha, T. (2019). Digital signature verification using artificial neural networks. *Int J Recent Technol Eng (IJRTE) Blue Eyes Intell Eng*, 7, 552.
- [25] Priyadarsini, M. J. P., Rajini, G. K., Naseera, S., Balaji, S., Reddy, P. S. K., & Gopichand, G. (2019). Automatic object recognition based on Euclidean distance restricted auto encoder, *ARPN Journal of Engineering and Applied Sciences*, 2019,Vol:14, Issue: 7, Pg.No(1352-1356)
- [26] Gopichand G., Sankeerth K.S.,Parlapalli A., Evaluation of recommendation systems using trust aware metrics, *International Journal of Recent Technology and Engineering*, 2019,Vol:7, Issue: 6, Pg.No(648-651)
- [27] Gopichand G., LellaV., Avula S.M., Enhancing performance of map reduce workflow through H2HADOOP: CJBT, *International Journal of Recent Technology and Engineering*, 2019,Vol:7, Issue: 6, Pg.No(652-656)
- [28] Santhi H., GopichandG., Pavan Koushik K., Nithin Krishna A., Sai Tharun D., Derma net: An automated skin lesion analyzer using cnn with adaptive learning, *International Journal of Innovative Technology and Exploring Engineering*, 2019,Vol:8, Pg.No(513-515),
- [29] Ganerawal K., Gayathri P., Gopichand G., Santhi H., Data mining in social networks and its application in counterterrorism, *International Journal of Recent Technology and Engineering*, 2019,Vol:8,Issue: 3, Pg.No(1278-1284), DOI: 10.35940/ijrte.B2333.098319
- [30] Gopichand G., Vamsi K.S.V., Subhash Reddy Y.S., Chand K.S.P., Saiteja G., A hybrid scheme in cloud computing for secure sharing of data in the cloud, *International Journal of RecentTechnology and Engineering*, 2019,Vol:8, Pg.No(3050-3053), DOI: 10.35940/ijrte.B1394.0982S1119
- [31] Santhi H., Gayathri P.,Gopichand G., Venkata Vinod Kumar N., Sailaja G., A scalable and distributed mechanism for DNA databases by aggregate queries, *International Journal of Innovative Technology and Exploring Engineering*,2019, Vol:8, Pg.No(1474-1477)
- [32] Santhi H.,Gayathri P., Katiyar S., Gopichand G., Shreevastava S., Study of symmetric-key cryptosystems and implementing a secure cryptosystem with DES, *Advances in Intelligent Systems and Computing*, 2019,Vol:862, Pg.No(299-313), DOI: 10.1007/978-981-13-3329-3_28
- [33] Palaniappan S.,Palli S., Gopichand G., Ameerjohn S., Gopal S.S., Enhanced handwritten number detection using kernel discriminant analysis (KDA), *Journal of Computational and Theoretical Nanoscience*, 2018,Vol:15, Issue: 8, Pg.No(2539-2543), DOI: 10.1166/jctn.2018.7494
- [34] Mehta M., Rajeshmamilla, Sunithavenugopal, Gopichand G., Growth and development of start-ups in India - A study with respect to mechanical and production engineering, *International Journal of Mechanical and Production Engineering Research and Development*,2018, Vol:8, Issue: 2, Pg.No(775- 780), DOI: 10.24247/ijmperdapr201888
- [35] Santhi H., Gopichand G., Gayathri P., Automated smart parking system using IoT, *Journal of Advanced Research in Dynamical and Control Systems*, 2018,Vol:10, Pg.No(1110-1115)
- [36] Gopichand G., SaravanaguruR.A.K., Ramesh Babu K., Fully secured intrusion detection system for sensing attacks in MANET, , *Journal of Advanced Research in Dynamical and Control Systems*, 2018, Vol:10, Pg.No(810-816)

- [37] Shaw J., Durai Raj Vincent P.M., Palaniappan S., Sangaiah A.K., Gopichand G., Intelligent phishing detection system using feature analysis, *Journal of Computational and Theoretical Nanoscience*, 2018, Vol:15, Issue: 8, Pg.No(2533-2538), DOI: 10.1166/jctn.2018.7493
- [38] Gayathri P., Agarwal M., Santhi H., Gopichand G., Bone breakage identification using image processing techniques, *Journal of Advanced Research in Dynamical and Control Systems*, 2018 Vol:10, Pg.No(1096-1103)
- [39] Swathi H.R., Sohini S., Surbhi, Gopichand G., Image compression using singular value decomposition, *IOP Conference Series: Materials Science and Engineering*, 2017, Vol:263, Issue: 4, DOI: 10.1088/1757-899X/263/4/042082
- [40] Gopichand G., Saravanaguru R.K., Ramesh Babu K., Usage of AODV and AOMDV protocols in perceiving black hole attacks in a MANET, *International Journal of Pharmacy and Technology*, 2016, Vol:8, Issue: 4, Pg.No(22305-22313)
- [41] Gopichand G., Saravanaguru R.A.K., Ramesh Babu K., Mitigating DDoS attacks through AODV protocol in a manet using NS3 simulator, *International Journal of Pharmacy and Technology*, 2016, Vol:8, Issue: 4, Pg.No(21807-21814)
- [42] Gopichand G., Saravanaguru Ra.K., A generic review on effective intrusion detection in ad hoc networks, *International Journal of Electrical and Computer Engineering*, 2016 Vol:6, Issue: 4, Pg.No(1779-1784).