**CSE4059 Cognitive Systems**

**DA-1**

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**PAPER 1:**

**Title: Enhancing user experience through an HCI research tool. Case study: Cognitive Urban Planning platform (PUC)**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. The main way of obtaining data highlighted in the paper was like that in smart cities. The major bulk of the data comes from IoT devices connected to our network which is then fed to our cognitive system to manage the city. As the paper highlights, “In a cognitive city, the citizen becomes an active element of urban governance, not only through civic participation but also through serving as a sensor for the operational state of the urban infrastructure”. This is the main philosophy behind cognitive urban planning and cities, with the target being the people living in the city and leading to a resilient, growing and sustainable city. The main dataset which was highlighted is one obtained from the people living int the city. The dataset includes all ranges from user fed data like power consumption by each family, consumption of water, average fuel consumption and some personalized data like household pantries, general resources and cleanliness. All these data come as the different input variables. Different combinations of these factors lead to an action taken by the user. All this information makes up the final dataset. The study was cited in 3 works and referenced in 26 works. The main research aspect of this paper was to find out the feasibility of an HCI system to plan and model a Cognitive Urban City. The main conclusion obtained from the highlighted research paper was that HCI can be said to be the core of ubiquitous embedded systems and cognitive systems, since a natural, intuitive and robust interface can, in theory, greatly reduce the space between human and machine, which is what is sought after by Cognitive systems. The major limitations highlighted in the paper include, working on and with human emotions. One of the solutions given was toe use of neural sensor devices to validate future works and system designs. The main innovations observed were the use of HCI or Human Computer Interface as an approach to model a Cognitive system. It uses User behaviour as a Human Aspect used to Interface with our Cognitive Computer System.

**PAPER 2:**

**Title: Collaboration-based Urban Planning Platform: Modelling Cognition to Co-create Cities**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. The data was collected through surveys from people, Device data in IoT network as well as Intelligent components. The main target/goal of the paper was to make use of a Cognitive system based on collaborative suggestions from the residents of an area to co-create cities. The Dataset included the ideal features in the cities and the importance of each of these features, all collected through user surveys. The main conclusion was that efficiency, sustainability and resilience influence the evolution of urban socio-technical systems and can be optimized with a collaboration based Cognitive system. The main challenge in this system would be the lack of actual educated individuals with data to properly feed our system and a filter to eradicate spam suggestions, or even a priority filter for suggestions

**PAPER 3:**

**Title: Social Trajectory Planning for Urban Autonomous Surface Vessels**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. The approach was mainly focused on a see-to-learn algorithm in which the cognitive system would be able to learn and adapt from real life scenarios as well as actions taken. The main target/goal of the system is to investigate the problem of learning a cost function for path planning from experts’ vehicle driving demonstrations and devise DNN architectures that can reconstruct a cost function using LIDAR data from vehicle and the demonstration. The dataset includes 2 major things, LIDAR data from the respective vehicles and Manoeuvre data from the driving demonstration giving by the professional. The paper covered all the different logical steps to devise cognitive algorithms for the previous goals and concluded that the key idea being to adopt the optimal control formulation in which the cost function is designed to find trajectories that resemble those of human-operated vessels. The result was further validated using AIS trajectory dataset. Some challenges faced and kept for future directions were improving the predictability performance of social trajectory planning and incorporating obstacle avoidance algorithms. The innovation seen in this paper was the algorithm designed and developed for the social trajectory planning.

**PAPER 4:**

**Title: Urban Annual Electricity Consumption Prediction Method Based On Fuzzy Cognitive Map**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. The main approach was to design and create a fuzzy cognitive map to predict energy consumption for a neighbourhood. The data is gathered from the previous years’ electricity consumption annually as well as trends. The main targets of this research paper and system are the electricity board to help and estimate possible power downtimes and failures. The dataset included yearly household electricity consumptions as well as the subsequent maintenance needed as well as trends in the consumption. The paper designed a proper Cognitive System based on Fuzzy Cognitive Map to predict Urban Annual Electricity Consumption and concluded the possibility of implementing such a method in real time. The challenges faced were mainly due to unforeseen factors and external factors like Weather, fallen poles, broken wires, short circuits etc, which hampered the data.

**PAPER 5:**

**Title: Virtual Target-Based Longitudinal Motion Planning of Autonomous Vehicles at Urban Intersections: Determining Control Inputs of Acceleration With Human Driving Characteristic-Based Constraints**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. This article describes the development and implementation of virtual target-based longitudinal motion planning of autonomous vehicles at urban intersections ensuring safety and ride comfort. In this study, virtual targets are designed to cope with oncoming vehicles in the blind zone at the intersection for safety. The true field of view of cognitive sensors and the virtual target states are constructed based on the sensor specification and intersection road information from a high-definition (HD) map. The future states and intention of sensor-detected targets are inferred and predicted with an interacting multiple model filter. The local IMM filters are employed with an intelligent driver model. Based on predicted target states, two driving modes-"cross" and "stop"-under three different intersection stages-"approach," "intersection in," and "intersection out"-are determined. The model predictive control (MPC) is formulated to determine the control inputs of acceleration with human driving characteristics-based constraints. The proposed algorithm is evaluated through simulation to indicate the effectiveness of the virtual target. The suggested motion planning has been implemented on an autonomous driving vehicle and tested on urban roads.

**PAPER 6:**

**Title: Trends and Challenges of HCI in the New Paradigm of Cognitive Cities**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. Currently, smart cities are generating tons of data, for example, to help people find a parking spot; to conserve water in parks, to monitor transport, crowds, and pollution levels, and to keep citizens safe. The smart cities' approach is related to improvements in citizen's life environment efficiency, security, and sustainability with monitored technological infrastructures. This study presents a summary of the new trends and types of equipment that are used in Artificial Intelligence Systems to support the urban planning process in the new cognitive cities paradigm were the human factor is the key. Based on the aforementioned, a Systematic Literature Review (SLR) methodology has been applied, originated by the searching for knowledge of social and technical situations about HCI. The results, which have been derived from data analysis, illustrate the impact of HCI in the digital age. Furthermore, they demonstrate some tendencies and approaches of the HCI research as well as artifacts and applications of HCI, and its relevance in the planning of cognitive cities.

**PAPER 7:**

**Title: Cyber Physical and Social Networks in IoV (CPSN-IoV): A Multimodal Architecture in Edge-Based Networks for Optimal Route Selection Using 5G Technologies**

**Literature Review:**

The main approach to designing the system was the Cognitivist approach to system design. The entire system was designed to perform a single task and could be ported to different systems with the same symbolic language representation. The idea of CPSN comprises of both the physical and virtual context of users, users at the same geolocation have some virtual context and existence at respective edge and cloud. The proposed term CPSN-IoV is the deep interplay of physical and smart objects, their association and, rule-based reasoning for collective and cognitive intelligence. It also can fuse diverse information that is initializing and observing from the physical world. Cognitive intelligence and CPSN-IoV technologies can provide human-centric services to cumbersome chores and tasks in physical worlds as well as in social worlds. In this study, they have proposed the cross-space, integrated and multimodal architecture of CPSN-IoV and discussed the key features to address different related aspects in order to reduce the complexity between heterogeneous data sources. Data processing for smart cities requires smart infrastructure to handle massive amounts of data in real-time. Therefore, this domain requires innovative ideas, techniques, and algorithms for efficient data execution in real-time and this study is an effort to initiate the implication of CPSN-IoV for pattern engineering, crowdsources and, social intelligence. Combining the sensory observation with social media feeds will not only be helpful in operational management and communication rather, but this will also enable a whole new paradigm that can implicate citywide services and solutions. Some of the challenges with CPSN-IoV are:

* Privacy and Security: One of the most vigorous challenges is the privacy and security of the architecture because the risk of being hacked at different levels of communication links is a real concern of every stakeholder as the geographically distributed and unattended devices are the common vulnerable objects for cyber-attacks
* Legislation and Regularization: In CPSN-IoV, communication technologies have the required number of dynamic ranges and characteristics of channels. It may be a complicated task for the government to create regulations and law as well, with other serious problems in the real world.
* Integration and Interoperability: System integration is also a problem due to data sharing among heterogeneous devices using multiscale platforms as a result, the performance of applications in CPSN-IoV will be reduced. Data interchange, portability and, interoperability are serious issues thus require to scale according to the system design and usage.
* Data Analytics: with the gradual change in technology, the huge amount of observation and data gathered from billions of objects e.g., sensors, actuators, mobile phones, smart cars, etc. can paralyze the big data processing and analytical companies. Currently, many companies are facing difficulties in data management, storage, and analytics for existing data. Consequently, conventional data analytics are not enough to address the big data processing and visualization issues