1. INTRODUCTION

Being underweight refers to having a body weight that is less than what is considered healthy for an individual's height, age, and gender. It is essentially the opposite of being overweight or obese. While many people struggle with being overweight, being underweight can also pose significant health challenges and concerns. Being underweight increases mortality and reduces life expectancy [1]. Physical activity is an essential requirement for the human body that can increase physical fitness while also having a favorable impact on mental health. This aids in the treatment of many ailments and the reduction of stress levels [2]. It is important to know the body's BMI category and ensure that BMI is within the normal category. Body Mass Index (BMI) is a calculation index that indicates a person's weight. Underweight is defined based on Body Mass Index, for adults (age $\geq$ 19 years) BMI is calculated using body weight (kg) / height (m^2). Based on the WHO classification underweight is defined by (BMI < 18.5), normal (18.5 $\leq$ BMI < 24.9), overweight (25.0 $\leq$ BMI < 29.9), obesity (30.0 $\leq$ BMI < 35.0) and severe obesity (BMI $\geq$ 35.0) [3].

The clinical definition of underweight in children and adolescents refers to having a low body mass index (BMI) for their age. This condition profoundly affects the health, well-being, and overall growth and development of young individuals, with potential consequences that can extend throughout their lifetime [4]. Physical activity in general is a movement of the body's muscles and their supporting systems that require energy to do so. Physical activity contributes to maintaining optimal health conditions, both physical and mental [5]. The importance of information about the right physical activity for underweight people to get the ideal weight. For example, MadMuscles [6] and Freeletics [7] are two applications that offer users training plans based on their preferences. These help users tailor their workouts to reach their fitness goals. Recommendation systems in the workout domain play an important role in helping users to find the right type of workout that is useful for their user needs. In knowledge-based recommendation systems for workout resources, ontologies are used to represent knowledge about users and their workout types [8]. In this study, we develop a recommendation system for workout menu based on ontology and Semantic Rule Web Language (SWRL). Semantic Rule Web Language is generally an OWL-based language for presenting generated rules. SWRL combines OWL knowledge base and inference rules to perform reasoning on the basis of OWL ontology [9]. Ontology-based approaches, such as [10]–[12], have been implemented to generate recommendations using domain knowledge and rules. Ontology plays an important role in knowledge representation [13], such as tourism recommendation [14], camera recommendation based on product functional requirements [15], and laptop recommendation based on product functional requirements [16].

In previous research, Shadi et al.[17]. Presented a personalized recommendation system to help people with diabetes for American Indian. The recommendations are based on the biocultural ontology of the AI (American Indians) community. Recommendations along with diabetes guidelines are converted into rule-basic logic that is integrated with the ontology as the knowledge of the recommender system.

Basnayke et al [18] developed a software application that employs an ontology-based approach to diminish physical exertion among individuals who are obese or overweight. The application takes into account anthropometric measurements, exercise inclinations, age, dietary habits, and medical background. To retrieve recommendations, researcher used Simple Protocol and Resource Description Framework Query Language (SPARQL) queries. Answering competency questions and expert testimonials ensures accuracy and correctness.

Sambola et al.[19] uses ontologies and semantic rules to create recommended menus that consider multiple measurements, height, weight, and BMI. According to [19], the system was able to select the diet that best matched each user's preferences, listing components and nutritional value dishes that met the prescribed dietary limits.

Meanwhile. Patricia et al. [20] Have conducted research with the title physical activity recommendation system during covid-19. In this study, researcher suggests at least 150 minutes of moderate-intensity physical exercise each week or 75 minutes of intense activity, and preferably 2-3 session of physical activity carried out by children, adults or the elderly.

In addition, Kadri et al [21]. announced a recommendation system for human physical activity using smartphones. In this study, the researchers used a decision tree algorithm and its BiLSTM (bidirectional long-term memory) algorithm to train and classify physical activity and compared the results of machine learning and deep learning algorithms.

In this paper, we propose the creation of an underweight workout menu recommendation system based on ontology and SWRL. This system aims to help underweight people to gain weight. This recommendation system includes repetitions and sets for each recommended workout movement. This system is implemented in

the form of a chatbot on the Telegram platform which will facilitate interaction between the user and the system to get workout recommendations that match the user's preferences.